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Vy truly Yours
Walter A. Dunn.

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THE
JOURNAL
OF THE
CINCINNATI

141

SOCIETY OF NATURAL HISTORY.

VOLUME XI.

1888-

JANUARY, 1889.

Publishing Committee.

GEO. W. HARPER,
H. P. SMITH,
O. D. NORTON,
J. A. HENSHALL,
DAVIS L. JAMES.

INDEX 1—10
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THE JOURNAL
OF THE
Cincinnati Society of Natural History.

VOL. XI. CINCINNATI, APRIL, 1888. No. 1.

PROCEEDINGS.

BUSINESS MEETING, *January 3rd*, 1888.

President Skinner in the chair.

Minutes of October business meeting were read and approved.

Mr. James A. Collins and Dr. Geo. E. Walton were elected members.

The minutes of the Executive Board were read.

Members were proposed as follows: John Pfaff, Henry Peachey, Jr., Dr. O. L. Cameron, Dr. Theo. Potter, Wm. Hochstetter.

The resignation of Judge M. F. Force was read, received and accepted.

A communication relative to the disbanding of the Cincinnati Chapter of the Agassiz Association, which had held its meetings in the rooms of the Society, was read.

Dr. B. M. Ricketts then read the memorial of Dr. W. A. Dun, prepared by his committee:

OBITUARY.

DR. WALTER A. DUN.

Past-President, Cincinnati Society of Natural History.

An investigator of Nature has fulfilled its laws, a student of Science has solved its highest problem, for Walter A. Dun rests from his terrestrial labors. Young in years, but mature in wisdom; of erudition, yet unpretentious; respected by all, and to all respectful; an incessant worker, brilliant and enthusiastic; frank, openhearted, humane and sympathetic, his death is a sorrow to all who knew him, and a serious loss to our Society.

Walter A. Dun was born at London, Madison County, O., in 1857. He entered the Ohio State University at the age of sixteen, and in 1878 graduated as Bachelor of Science. He then entered Miami Medical College, Cincinnati, and completed a most successful course by winning the prize awarded by the Faculty to the head of the graduating class. Dr. Dun then went to England, and after further study and practice in the London hospitals, passed the examination for Licentiate of the Royal College of Physicians, and Member of the Royal College of Surgeons. In 1883 he returned to Cincinnati to practice his profession, and by merit and hard work, by genius and indefatigable industry, by amiability and good judgment, he rose in the community and succeeded in his profession in a manner almost marvelous. He became Professor of Miami Medical College, Lecturer of the University of Cincinnati, Physician to the Episcopal Hospital for Invalid Children, a contributor to scientific publications, President of the Cincinnati Society of Natural History, Member of the American Association for the Advancement of Science, of the American Medical Association, of the Ohio State Medical Society, of the Cincinnati Medical Society, and of numerous clubs and lodges. After a brief attack of meningitis, he died October 7, 1887, aged 30 years.

Thus in the midst of his usefulness, at the commencement of a promising career, a good and noble man has been cut off by the grim reaper—Death. To the bereaved family of the departed the Cincinnati Society of Natural History offers its condolence; and to the memory of Walter A. Dun it places on record this tribute of estimation and affection.

B. Merrill Ricketts.
A. E. Heighway, Jr.
Raphael Benjamin, M. A.

On motion of Dr. A. E. Heighway, Jr., seconded by Dr. Ricketts, Rev. Raphael Benjamin was elected to fill the vacancy in the Executive Board created by the death of Walter A Dun.

Dr. Heighway, Sen., Chairman of the Audubon Monument Fund Committee of the Society, rendered a partial report, to the effect that no funds had as yet been raised beyond five dollars. contributed by himself. It was ordered that the committee be continued.

Dr. C. E. Caldwell read a paper on the Present Status of our Knowledge of the Causal Relation of Microscopic Organisms to Disease.

He opened by defining in a general way the nature of the state of disease in a living organism, and emphasized the diseases of environment. The discovery of the miscroscope, and its efficient use in the hands of Luewenhoek, Muller, Schwam, and de la Tour, extended the study of environment into wider fields, and place it on a more scientific basis.

Nageli and others established the vegetable nature of many of the organisms thus revealed by the microscope, and Cohn made a classification of them according to form.

This latter system was opposed by Billroth and others, and a final classification according to function was made by DeBary.

The bold theories of Haller and other tyros gave the subject a backset until the practical achievement of Lister revived confidence.

The Doctor stated that he expected to continue the paper at a future meeting.

The following paper by Prof. Jos. F. James, of Miami University, was read:

REMARKS ON THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

By Joseph F James, M. S., *Miami University, Oxford, O.*

In arranging the Index to the first ten volumes of the Journal of this Society, certain points were manifest which I venture to think may be of interest to the members.

As long ago as January, 1876, was published No. 1 of the Proceedings of the Cincinnati Society of Natural History. This was the only number ever published, and it contains a tinted lithographic plate with figures of five new species of shells, by Prof. A. G. Wetherby. This was more than two years before the first number of the Journal was issued, that bearing the date of April, 1878. The prospectus, as printed on the first page of the Journal, defines the object to be to "contain a full report of the Proceedings of the Society, all valuable papers read before or prepared for it, critical notices of scientific books and publications, etc." Further, it was decided to illustrate all new species described, either by woodcut, lithographic plates, or such other methods as may appear best adapted to the character of the object to be illustrated. How far these promises were carried out, and how the original design of the JOURNAL was for a time perverted, remains to show.

As a record of the Proceedings of the Society, the JOURNAL is, in the early volumes, not reliable. Let us glance at this a moment and see. In the first number of the first volume we find a list of the officers from the organization of the Society, covering two pages; and then a history of the Society from its organization in 1870 to February 1878, occupies eight pages. In the second number less than four pages are devoted to the Proceedings for April, May and June. In the third number the Proceedings for three months fill one page, while in the fourth number only two pages are given up to them. What fills the other 175 pages of the volume? They are taken up with articles, the most of which were never read before the Society, and the first knowledge of the existence of which the members received through the JOURNAL. With the other volumes, down to the close of Volume VII, it was nearly the same. Sometimes two pages, sometimes four, seldom more, and sometimes none at all were devoted to the Proceedings for the three months preceding the issue. The articles which filled the pages were prepared "for" the JOURNAL, but were not "read before" the Society. The close of Volume VII, however, saw a change introduced, and since then no paper has been published which has not either been read before the Society in full, by abstract or by title. The last three volumes of the JOURNAL may, therefore, be regarded as being really a record of the Proceedings.

Another part of the original programme of the JOURNAL was more fully carried out. This was the illustration of new species described. Plates were most profusely furnished, and since the first volume, which had six, none have appeared with less than four, except Volume X, which had but two. The majority of these plates are lithographs. Adding all up, we find in the ten volumes eighty full-page plates. What, now, was the character of these? They indicate the work which the JOURNAL has been most concerned with. Of the total number of eighty no less than sixty-three were devoted to fossils; eight illustrated plants; seven, anthropology; one, birds, and one, animals. The sixty-three plates represent many new species of fossils, though in some cases old species are figured or the new ones are shown in several ways.

A very large number of the articles are concerned with the Natural History of Cincinnati and its vicinity, and by a careful study of the pages of the JOURNAL it would be possible to get an excellent idea of the plants, beetles, butterflies, birds, mammals, and fossils of our vicinity. It would now be a wise idea to have these various catalogues revised, corrected and reprinted, with notes, or indeed, if possible, with descriptions, and have them bound together, as a contribution to science by the Society. This would provide students with a guide to the study of the natural history of the locality, which they could not get in any other way, and which they could get now only by long years of patient collection and study.

The value of a Journal of a Natural History Society consists in its local work. In future years it will be quoted as an authority, and while it is well to occasionally admit articles foreign to the locality when of exceptional merit, I would question the advisability of extending researches over the whole earth. Every year shows some new field which is waiting to be explored, or some old one which needs to be revised. And although much has been done here, more remains. We have no list of fishes, of reptiles, of shells, of neuroptera, diptera, hymenoptera, orthoptera, of sponges, of algæ, mosses or lichens. Our knowledge of many groups of fossils is so scattered as to be almost inaccessible; and though I have endeavored to supply to some extent the need, much still remains.

One of the features which has been noticed in the early volumes of the JOURNAL is the lack of an Index. The first volume contains 194 pages, but the Index occupies less than one page, and contains exactly thirty lines! In none of the other volumes up to VI, does the Index occupy more than two pages, double column, but VI, VII, VIII, IX, and X have full indices. It is hoped and believed that the Index of the ten volumes supplied to volume X, may meet a long felt want, making as it does the contents of all the volumes accessible to the student.

There are but few papers in the JOURNAL which are not complete, although some of them extend over many numbers. The paper in the first number entitled "Contributions to Palæontology, by S. A. Miller and C. B. Dyer," was continued by a second part, issued separately, and never appearing in the JOURNAL. Thus it is difficult of access, and is generally quoted as "M. & D. Contri. to Palæ., Part 2," whereas Part 1 is quoted from "Jour. Cin. Soc. Nat. Hist., Vol. I." The article by Mr. E. O. Ulrich on "American Palæozoic Bryozoa" extended through volumes V, VI and part of VII, but was never finished. Where the conclusion can be found, if indeed it has ever appeared, I am not able to say. A third article on the "Mycologic Flora of the Miami Valley," by Mr. A. P. Morgan, has also been continued through several volumes, generally with one or two installments a year, but its author is still at work. These three are the only articles which have remained so far unfinished.

The JOURNAL as whole may be taken as representing fairly the amount of scientific work done in this locality during the past ten years. And though Cincinnati has never laid claim to being a scientific center, the showing is not a bad one. One thing is to be noted. Many of the contributors to the early numbers of the JOURNAL, indeed, I may say nearly all of them, have dropped away. Some are dead; more seem to have ceased their labors, or if they still continue, find places of publication elsewhere. Their place has been taken by another set of workers, who are, generally speaking, engaged in other branches besides that of describing new species of fossils.

Mr. D. L. James stated on behalf of the Publishing Committee that Prof. James' offer to index the first ten volumes of the JOURNAL had been accepted by the Committee, and the work had already begun.

Another communication by Prof. James was then read, as follows:

To the President and Members of the Cincinnati Society of Natural History:

SIR, LADIES AND GENTLEMEN:

The suggestion embodied in a paragraph of my remarks on the JOURNAL of this Society has since seemed to me worthy of further elaboration, and I beg to call attention to it for another purpose. I refer to the remarks relative to reprinting the catalogues of birds, plants, etc., of this locality which have at times appeared in the JOURNAL.

We have lately lost one of our former presidents, and in him one of the most active and enthusiastic members of the Society. It seems to me that a memorial to the late Dr. Walter A. Dun would be the proper thing for the Society to publish, and I would suggest the following as matter for the memorial volume:

Let it contain a portrait and a sketch of his life. Let there then follow in regular order catalogues of the fossils, plants, birds, mammals, shells, etc., etc., found in the vicinity of our city, accompanied by notes, or, better still, by short descriptions of the genera, and if possible the species. And let such other matter be added as will give an adequate idea of the scientific treasures of our neighborhood. We should thus have an epitome of the natural history of our city and its vicinity, which would be not only a monument to the memory of Dr. Dun, and one which he would have appreciated, but a work of vast usefulness.

Let me illustrate why this last would be the case. Suppose a young person desirous of studying the fossils so numerous in our neighborhood, and also desirous of identifying his specimens as he finds them. In the present state of palæontology he is compelled to seek the large libraries of the city, if he lives there, or of his friends, if he has any. The volumes necessary to consult are beyond the reach of the majority, as they are so numerous as to compel one to spend a small fortune for them. It is the same with other branches. Take, for instance, beetles or butterflies. What book is there for a young student to turn to? With one exception, none whatever. So that he is compelled to stagger along under enormous difficulties, carrying his specimens to the collections of his friends, and often even then receiving no definite satisfaction for his pains. With birds, animals and plants it is a little different. Here, it is true, we have manuals, but even in these cases a condensed manual would narrow the labor down to such a point that it would become a pleasure instead of a task.

Such a memorial volume as I suggest, could be published by subscription of the very numerous friends of Dr. Dun, under the sanction of the Society. The latter, in the event of not enough money being collected, agreeing to bear the balance of the expense. As an earnest of my desire to see this project carried out, I will subscribe $5 to head the list—the ability and not will is the only limit to the amount of the subscription.

Respectfully, JOSEPH F. JAMES, M. S.
Miami Univesity, Oxford, O.

It was ordered that the consideration of publishing a memorial volume, as suggested in the commuication, be left to a committee.

The Chair appointed Messrs. Dury, Fisher and Knight, committee.

Mr. Dury read some extracts from a letter from Mr. William Doherty, now traveling and collecting in Borneo.

The President, Mr. Skinner, donated to the Society a copy of Audubon's Birds of America, on condition of its being properly displayed and cared for.

Dr. Heighway, Sen., discussed the peculiarities of certain crania exhibited on the table.

Adjourned.

Donations received during the previous month were as follows:

From B. W. Evermann, Terre Haute, Ind., Pamphlets, viz: Hoosier Naturalist, May, 1887; Food Fishes of Indiana; List of Fishes collected in Harvey and Cowley Counties, Kansas; Description of Six New Species of Fishes from the Gulf of Mexico; A Revision of the American Species of the Genus Gerres; Ornithologist and Oologist, June, 1886. From Seceretary of the Treasury, Washington: Report of Commissioner of Navigation for 1886. From Smithsonian Institution: Pamphlet, Republic of Mexico in 1876. From Samuel Garman, Cambridge, Pamphlet, On West Indian Reptiles and Batrachians. From A. J. Evans, City, Ray Fish. From Dr. A. E. Heighway, Jr., Specimens of Talc. From Tennessee State Board of Health, Bulletins.

Adjourned.

SCIENTIFIC MEETING, *February 7th*, 1888.

President Skinner in the Chair. Mr. H. P. Smith, Secretary, *pro tem.*

Mr. Skinner opened the meeting with remarks on the death of Dr. A E. Heighway, Sen., and upon his work for the Society, closing with the suggestion for the appointment of a Committee to prepare a memorial in tribute to his memory.

Remarks were made by Mr. Dury and Col. A. W. Abert.

Dr. W. W. Dawson, Dr. R. M. Byrnes and Wm. H. Knight were appointed a committee to draft the memorial.

The following gentlemen were elected to active membership: Messrs. John Pfaff, Henry Peachy, Jr., Wm. Hochstetter, Dr. O. L. Cameron, Dr. Theo. Potter.

The following named persons were proposed for membership Dr. Geo. B. Orr, Dr. Konn Sayres, Dr. D. D. Bramble.

Mr. Wm. Hubbell Fisher was appointed to fill the vacancy in the Audubon Fund Committee, created by the death of Dr. A. E. Heighway, Sen.

Mr. Chas. Dury, of the Committee on a Memorial Volume to Dr. Dun, reported that an engraved portrait for an edition of 500 would cost about $50; an elegant photogravure by Gutekunst, of Philadelphia, would cost about $23. Mr. James thought that $500 would cover the entire cost of one edition of 500 copies.

The Committee was granted further time.

The President suggested that as an educational work, Messrs. Van Antwerp, Bragg & Co. would perhaps undertake the publication.

Mr. Monteith promised all the aid in his power.

Mr. Bullock begged to announce that it had been determined to raise $3,000 to dedicate a bed in the Episcopal Hospital for Children to the memory of Dr. Dun, and that they needed further subscriptions to complete the sum. He stated further that the photographic section was making an enlargement of the photograph of Dr. Dun for the Society.

Mr. Smith then read, as by announcement, his paper on Foreign Museums.

MUSEUMS OF NATURAL HISTORY.

(*Abstract.*)

H. P. Smith.

Little is known of the origin or early collections of natural history specimens. Professor Beckmann expressed the opinion that in the custom of preserving curious and remarkable objects in temples, we find the origin of such collections.

During the first twelve centuries of the Christian era scarcely anything was done in the study of Nature, and the work of early naturalists, such as Aristotle, was all but lost.

The awakening which came to all departments of knowledge and investigation in the middle of the fifteenth century, brought life to the study of natural history, and as collections are necessary to the naturalist, we find the work of collecting taken up with great zeal, but little knowledge.

The discovery of alcohol and the resumption of the use of paper were factors of inestimable value in the growth of natural history.

Among the early collectors may be mentioned Gesner, of Switzerland, and Besler, a prominent physician of Nuremburg.

The formations of Academies of Natural Science was the next important step. The Academia Sacretorum Naturæ, established in 1560, was among the first of such institutions, but it was soon suppressed by the popes.

The Royal Society in London, the Leopoldine Academy in Germany, and the Academy of Science in Paris, all established between 1666 and 1670, are still enjoying a vigorous existence. The establishment of Museums of Natural History followed closely the founding of Academies. In the earliest days of Museums the Dutch Cabinets were the most famous.

From this time we note the steady and rapid growth of museums from these small beginnings to the magnificent institutions of to-day, such as the British Museum, Smithsonian Institution and Natural History Museum of Florence.

Mr. Knight spoke on the cost and maintenance of collections in this country.

Mr. Skinner spoke interestingly on astronomy, showing the nicety with which the apparently independent movement of bodies are governed and controlled by their relation to one another.

Donations were announced as follows:

From Wm. McMaster, Lower Jaw of Boar; from Wm. Glasford, Red Lion, O., Golden Eagle; from B. Konn Sayres, M. D., Short Eared Owl; from W. T. Orange, Pair of Pileated Woodpeckers; from D. G. Brinton, M. D., Philadelphia, Pamphlets, viz: On the so-called Alaguilac Language of Guatamala; Ancient Human Footprints from Nicaraugua; From Sam'l Garman, Cambridge, Pamphlets: Natural History Notes, Science Observer, On the Reptiles and Batrachians of Grand Cayman; from Charles E. Beecher, Albany, Pamphlet: A Method of Preparing for Microscopical Study the Radulæ of Small Species of Gasteropoda; from A. J. Howe, M. D , Pamphlet: Michael Angelo; from Tennessee State Board of Health, Bulletins; from Public Library, Museums and National Gallery of Victoria, N. S. W., Pamphlet: Prodromus of the Zoology of Victoria, Decade 15.

Adjourned.

SEIENTIFIC MEETING, *March 6th*, 1888.

President Skinner in the Chair. 13 members present.

The minutes were read and approved.

On behalf of the Committee the Secretary read the following:

REPORT OF THE COMMITTEE ON THE DEATH OF DR. A. E. HEIGHWAY.

Your Committee respectfully report:

Dr. A. E. Heighway was, as a lover and investigator of Natural History, identified with the Association in that department of science in Cincinnati prior to the organization of this, the present Society, into which the collections of that Association merged. Though not on the original roll of the present organization, he became a member of the Society in the second year thereafter—on the 2nd day of January, 1872—and from that time on until the date of his decease was a constant member and attendant on the meetings of the Society, its true friend and a frequent contributor of specimens and interesting suggestions in its various departments of research.

The passing away of this, one of our oldest members, is to be more especially noticed inasmuch as he was identified with the origin of our city, as belonging to its pioneer families. His father was John Heighway, who served through the war of 1812. His mother was Mary Mercer, daughter of General Mercer, a Revolutionary hero. Of these parents Dr. A. E. Heighway was born in the city of Cincinnati, Dec. 26, 1820. Educated as a physician in 1842, under Dr. J. T. Shotwell, he afterward served as Surgeon in the Mexican War. Though retired from the practice of his profession for many years, he always retained a decided interest in it, and at the time of his death was Vice-President of the Hamilton County Medical Society. He continued the military career of his family by rendering service as Surgeon on the Union side in the late Rebellion, and at the time of his decease was a member of the Army of the Tennessee.

W. W. Dawson.
Jas. W. Abert.
R. M. Byrnes.
J. R. Skinner.
Wm. H. Knight.

The report was accepted and ordered spread upon the minutes.

A request from the Commissioners of the Centennial Exposition to the Society to make a display in the Educational Department was read. President Skinner stated that the matter had been discussed at the last meeting of the Executive Board, where the opinion prevailed that a display should be made, and he (Mr. Skinner) had been appointed a committee, choosing as co-laborers the other members of the Executive Board and Mr. Dury, to make necessary inquiries and take necessary steps. It was found, however, that the Constitution forbid the removal of any part of the collections without the permission of the Society. It was therefore necessary to have some action on the part of the Society.

At the request of Mr. Skinner, Mr. Smith, the Custodian, had prepared a plan for a display, and calculated that 150 square feet would be necessary for the same.

Mr. Dury was of the opinion that under no circumstances should the collections in the Society's building be torn up for the sake of the Exposition; that it was hoped that the expected influx of visitors could also be attracted to the Society, where the exhibits ought to be as perfect as possible. He was, however, in favor of making a small display of a few striking specimens, to act as an advertisement of the Society to draw visitors to the Museum.

Messrs. Harper, Norton and James, in discussing the matter, concurred in Mr. Dury's opinion, and rejected Mr. Smith's plan as involving too considerable a removal of specimens.

Mr. Dury moved that a committee be appointed to designate what specimens had better be exhibited, in conformity with the above idea, and report at the next meeting. Carried.

The Chair appointed Messrs. Harper, James and Smith, committee.

Mr. Skinner informed the Society that it had be intimated that there was danger of losing Mr. S. E. Wright, as Treasurer of the Society, a post he has occupied for many years.

Whether a change in the office became necessary at this time or not, it would at any time be very difficult to fill the office of Treasurer because of the high bond required of him. The President, therefore, suggested that the following reading be adopted for Article VI, Section 3, of the Constitution:

"Two trustees shall be elected at the next annual meeting, one of whom shall hold office for the term of one year, and the other for two years. And thereafter there shall be elected annually one trustee who shall hold his office two years. These two trustees shall be intrusted with, and have charge of all funded property of the Society, with power to sell and re-invest according to their judgment. Bonds shall be required of these trustees in such sums and with such sureties as may be satisfactory to the Executive Board. The net income from said funded property shall be paid over by said trustees to the Treasurer of the Society, on the written order of said Treasurer, approved by the President of the Society."

And the following for Article II, Section 4, of the By-Laws:

"The Treasurer shall have charge of all money or other property of the Society, excepting the Museum and its contents, and excepting also such property as may be placed by the Society or the Executive Board in the hands of the trustees; he shall also have charge of the net income of the funded property of the Society, to be paid over to him by the trustees, as herein before provided. He shall collect all fees and assessments; shall pay all accounts against the Society when the same shall be approved by a vote of the Executive Board; shall keep a correct account of all receipts and expenditures in books belonging to the Society, and shall, at each annual meeting, and at all other times when required by the Executive Board, make a detailed report of the same. He shall notify members who are in arrears, of their indebtedness to the Society, and shall report all delinquencies to the Executive Board annually. Bond with sureties may be required of the Treasurer for the faithful discharge of his office, by the Executive Board, in such sum as may be deemed satisfactory by the said Board."

The suggestions seemed to meet the approval of the members present, and Mr. Knight gave notice, with Mr. James as second, that he intended to move the above as amendments to the Constitution at the next meeting of the Society.

Mr. Dury reported on behalf of the Committee on Memorial Volume that the same would cost $400 for an edition of 500 copies.

Mr. Harper then suggested that the next number of the JOURNAL of the Society be made a memorial number, as other material was scant. It would not, in this case however, be possible to carry out the idea of an educational work with catalogues, etc., as first contemplated.

The Publishing Committee then accepting the material of the Committee on Memorial Volume, the project of publishing such a volume was dropped.

Drs. J. T. Woods and S. J. Mills of Toledo, O., and Messrs. Edgar R. Quick and A. W. Butler, recommended for corresponding membership by the Executive Board, were then elected.

Dr. A. E. Heighway then requested the Executive Board to consider the eligibility of Mr. T. H. Lindsay, of Asheville, N. C., for corresponding membership.

Dr. Geo. B. Orr, Dr. Konn B. Sayres and Dr. D. D. Bramble were elected to active membership.

The following persons were proposed for active membership: Miss Lucia Stickney, Mr. A. A. Ferris, Miss Eugenie Iliff, Mr. W. L. Reum, Mr. Nathaniel H. Davis.

Donations were received as follows:

From Mr. Robert F. Leaman, Mounted Head of Moose; from H. Illoway, M. D., Specimens of Minerals; from Prof. E. W. Claypole, Akron, pamphlet, The Materials of the Appalachians; from Mrs. M. L. Morehead, Columbus, Memoir of Prof. James P. Espy; from Prof. Jos. F. James, Oxford, Miscellaneous pamphlets.

Adjourned.

ON THE MONTICULIPOROID CORALS OF THE CINCINNATI GROUP, WITH A CRITICAL REVISION OF THE SPECIES.

By U. P. James and Joseph F. James, M. S., *Prof. of Botany and Geology in Miami University, Oxford, O.*

(Concluded from Volume X, p. 184)

Group IV. *Laminar* or *Frondescent.*

Expanded or flattened, generally formed of two layers of corallites, diverging from a central axis.

a. Surface with conspicuous, generally elongated monticules.
- * Interstitial corallites absent......................35
- * Interstitial corallites few 36
- * Interstitial corallites numerous..................37

b. Surface with small, rounded monticules, or nearly smooth.
- * If present, monticules formed of small tubuli; corallites direct to surface........ 38
- * Calices in intersecting, diagonal lines; elongated, pentagonal 39
- * Corallum irregular.
  - † Calices circular. 40
  - † Calices irregular in form 41

35.—M. CLEAVELANDI, U. P. James.

Monticulipora (*Heterotrypa?*) *cleavelandi*, James, The Palæont., 49, 1882.

Corallum lobate or amorphous, with flattened or cylindrical branches. Surface with rounded monticules, more or less conspicuous, about one line apart, occupied by calices larger than in other places. Calices polygonal or sub-circular. No interstitial pores at surface. (Plate 1, Fig. 4).

Obs.—This species presents various forms, often branching, but generally forming irregular masses. The cells are arranged in rows of from eight to ten, and the monticules in alternating rows. There are no interstitial pores to be observed.

Formation and Locality.—Lower Silurian, Cincinnati Group, Highland Co., Ohio.

36.—M. DAWSONI, Nicholson.

Monticulipora (*Heterotrypa*) *dawsoni*, Nich., Genus Montic., 141, 1881.

Homotrypa dawsoni, Nich. Ulrich. Jour. Cin. S. Nat. Hist., V. 241, 1882.

Corallum irregularly lobate or frondose, forming an undulated expansion of variable size, about two lines thick. Surface with numerous close-set, prominent monticules, markedly elongated, about a line or less apart, and occupied by corallites not differing conspicuously in size from those forming the mass of the corallum. Calices polygonal, thin walled, nearly vertical from a central axis, and opening on either side; no regular series of small apertures, but occasionally a few spiniform corallites at angles of junction of cells. Walls delicate, wrinkled, slightly thickened toward mouths of cells.

Obs.—This is similar to the next, *mammulata*, but seems to differ in the more prominent, elongated and closely set monticules.

Formation and Locality.—Lower Silurian, Cincinnati Group, Warren and Clinton Counties, O. Rare at Cincinnati.

37.—M. MAMMULATA, D'Orbigny.

Prodr. de Paleont., I, 25, 1850; Ed. & Haine, Brit. Foss. Cor., 265, 1854; Ulrich, Jour. Cin. S. N. Hist., V. 234, 1882.

Chætetes mammulatus, Ed. & H., Pol. Foss. des Terr. Pal. 267, 1851; Nicholson, Quar. Jour. Geol. Soc., XXX, 508, 1874; Pal. Ohio, II, 207, 1875.

Monticulipora (*Heterotrypa*) *mammulata*, Nich., Pal. Tab. Cor., 294, 1879; Genus Montic., 104, 1881.

M. (*Peronopora*) *molesta*, Nich., Genus Montic., 224, 1881.

Corallum in undulated expansions, two to six lines or more thick, often consisting of several layers of corallites, diverging from an imaginary plane and opening on both sides; occasionally massive. Surface with rounded, conical or elongated monticules, either conspicuous or only slightly raised; these occupied by corallites either slightly larger or slightly smaller than the average; or else the sides with full-sized, and the summit with smaller corallites. Calices of two kinds: large ones polygonal, or sub-polygonal, moderately thickened at the surface; small ones moderately numerous, intercalated between the larger tubes, variable in size and shape, but always angular or sub-angular. Spiniform corallites variable in number.

Obs.—This is a species about which there has been much discussion. It has been considered the type of the genus, as it was the first one described by D'Orbigny, but as the original description was very defective, discussion has arisen as to what really should be considered *mammulata*. *M. molesta*, Nich , seems to be nearly the same *externally*, though it has a smaller number of interstitial corallites. Internally *mammulata* has nearly straight tabulæ, while *molesta* is said to have a series of vescicles on the sides of the walls of the corallites.

One of us has a specimen about nine inches across the longer diameter, and five inches in the smaller. About four inches of the longer diameter forms a dome-shaped mass, with an irregular surface, covered with small, closely set monticules. Inside the specimen there are several branches running from the cap-like top downwards, and spreading out into a wonderfully interlaced mass of frondescent branches. The whole interior of the specimen is filled with a mass of clay which surrounds the frondose branches on all sides.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati, O.

38.—M. FRONDOSA. D'Orbigny.

Prodr. de Paleont., I, 25, 1850.

Chætetes frondosus, Edw. & H., Pol. Foss. des Terr. Pal., 267, 1851, Nicholson, Quart. Jour. Geol. Soc., XXX, 508, 1874; Pal. Ohio, II, 208, 1875; Ann. Nat. Hist., ser. 4. XVIII, 91,. 1876.

Chætetes decipiens, Rominger, Pro. Acad. Nat. Sci. Phila., 116, 1866.

Monticulipora (*Peronopora*) *frondosa*, D'Orb., Nich., Genus Montic., 216, 1881.

Heterotrypa frondosa, D'Orb., Ulrich, Jour. Cin. S. Nat. Hist , V. 235, 1882.

Chætetes compressus, Ulrich. Ibid, II, 27, 1879.

Peronopora compressus, Ul. Ibid, V, 244, 1882.

P. uniformis, Ul. Ibid, V, 244, 1882.

Homotrypa curvata, Ul. Ibid, V, 242, 1882.

Corallum of erect, flattened, undulating expansions of variable height, and varying from less than one to four lines thick. Surface with numerous rounded or stellate spaces, either elevated to form monticules, or level with the general surface, and composed mainly of small tubuli. Larger calices moderately thick walled, irregularly circular, oval or sub-polygonal. These surrounded by a variable, generally large number of smaller, irregularly shaped calices, occupying the intervals between the preceding, and sometimes almost surrounding them. Spiniform corallites numerous, placed on margins of calices or forming apparently closed tubercles. Corallites springing from both sides of median axis, forming two laminæ, sometimes marked by a calcareous membrane; oblique and thin walled at first, but soon bending outwards and proceeding straight to the surface, the walls there moderately thickened.

Obs.—This species grows in much the same manner as *dawsoni* and *mammulata*. It is distinguished from the former by the smoother surface, and from the latter by this, as well as the fact that the corallites pass from the separating membrane directly to the surface. The calcareous plate is sometimes so well defined that a specimen may be fractured along it and separated into two halves. One of us has specimens in this condition.

The identy of *decipiens*, Rom., with *frondosa*, D'Orb., has been denied by some. We adopt the view of Dr. Nicholson, and consider it as a synonym. Some have also claimed that *frondosa* is one of the forms generally taken as *mammulata*.

Formation and Location.—Lower Silurian Cincinnati Group, Cincinnati, O.

39.—M. PAVONIA, D'Orbigny.

Ptilodictya pavonia, D'Orb. Prodr. de Paleont., Vol. I, p. 22, 1850.

Chætetes pavonia, Ed. & Haime. Poly. Foss. des Terr. Pal. p. 267, 1851; Rominger, Proc. Acad. Nat. Sci , Phila., p. 116, 1866.

Cyclopora jamesi, Prout. Trans. Acad. Sci., St. Louis, Vol. I, p. 578, 1860.

Stictopora clathratula, James. Cat. Foss. Cin. Gr. (named but not figured or described), 1871.

Chætetes clathratulus, James. Nicholson, Quart. Jour. Geol. Soc., XXX, p. 259, 1874; Pal. Ohio, II, p. 209, 1875. Ann. Nat. Hist., ser. 4, XVIII, p. 91, 1876.

Heterodictya pavonia, Ulrich. Cat. Foss. Cin. Gr. (named but not figured or described), p. 10, 1880.

Corallum forming a thin, undulating expansion, often of considerable extent, varying in thickness from one to about two lines, the corallites in two layers with their bases fixed to a medium plane marked by a delicate membrane and opening on opposite sides of the corallum. Surface often with low, rounded monticules, often obscure, and arranged in diagonal rows at intervals of from one to one and a half lines apart, occupied by calices of ordinary size.

Corallites generally oblique at their origin, but almost immediately bending outwards, and opening at right angles to the surface or nearly so. Calices elongated, pentagonal, tolerably uniform in size and often arranged in obliquely intersecting lines. No interstitial tubes..

Obs.—This species is readily recognized by its thin, undulating corallum, which carries on both sides the sub-equal, oval, or pentagonal calices, generally arranged in decussating lines. One of us has a specimen about nine inches by four, which must have been considerably larger, as the edge is fractured all round. The surface is very irregularly and deeply undulated, the corallum varying in thickness from a little less to a little more than one line. Conspicuous but low moticules are distributed all over the exposed side, the other one being firmly attached to a mass of indurated clay containing fragments of fossils. Other specimens show a *pointed base.* None of them show the non-poriferous margin said to be characteristic of *Ptilodictya.* A medium lamina is shown in some specimens, and the impressions of the corallites is often seen in these.

Considerable discussion has arisen relative to the zoological position of this species, some calling it a coral and some a polyzoan. As it has been often referred to the Monticuliporoids, the description is here given without any positive assertion as to its title to the position.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati, O.

40.—M. VAUPELI, Ulrich.

Heterotrypa vaupeli, Ul., Jour. Cin. Soc. Nat. Hist., VI, 85, 1883.

Corallum irregularly twisted, formed of more or less inosculating masses; several inches in diameter, and consisting of convoluted fronds, varying from one and one-half to three lines thick. Surface sometimes smooth, but usually with irregularly arranged small, rounded or conical monticules; the summit of these subsolid, and each occupied by maculæ of small cells Calices circular, arranged in decussating lines, more or less curved around the monticules. Generally one or two rows of cells larger than the average surrounding the maculæ. Interstitial spaces sometimes smooth and apparently solid (in worn specimens); sometimes with small interstitial cells, and again (in the best preserved specimens), with numbers of spines or granules on the walls of the interstitial cells.

Obs.—This species, we are told,* is readily distinguished by its "peculiar growth, circular cell apertures, and regular arrangement of the cells and monticules. When in a good state of preservation the most striking characteristic is found in the granular cell interspaces." It is similar in some respects to the next.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati and Waynesville, O.

41.—M. CLINTONENSIS, U. P. James.

Monticulipora (*Heterotrypa*) *clintonensis*, James. The Palæont., 45, 1882.

Corallum variable, flattened, undulating, thickened or contorted, amorphous, and occasionally appearing as if branched. Surface with rounded, more or less prominent monticules, or at times nearly smooth. Cell apertures of various forms, the walls indented or expanded irregularly. Interstitial corallites more or less numerous at the angles of larger tubes. Spiniform corallites few to numerous. (Plate 1, figs 1, 1a)

Obs.—The indented walls of the calices, and the peculiar mode of growth will generally distinguish this species. It is similar in mode of growth to *M. vaupeli* and to *M. varians*, but these possess other features which distinguish them.

Formation and Locality.—Lower Silurian, Cincinnati Group, Clinton and Warren Counties, O.

Group V.—*Incrusting species;* forming patches or crusts growing parasitically on shells of various kinds, or on corals.

a. Corallum forming a thin crust.
    † Monticules prominent, elongated..................42
    † Monticules rounded, arranged in regular lines.
        * Calices irregular, indented....................43
        * Calices polygonal..............................44
    † Surface nearly smooth.........................45, 46
b. Corallum forming small circular patches..............47
c. Corallum growing in irregular masses about crinoid columns..48
d. Corallum fusiform, cylindrical or clavate.........49, 50
e. Corallum nearly hemispherical.......................51

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*Jour. C. S. N. H., *l. c.* vi, 87.

42.—M. TUBERCULATA, Edw. & H.

Monticulipora (*Monotrypa*) *tuberculata*, Edw. & H. Nicholson, Genus Montic., 200, 1881.

Chætetes tuberculatus, Ed. & H. Pol. Foss. des Terr. Pal., 268, 1851; Nicholson, Ann. Nat. Hist. ser. 4, XVIII, 91, 1876.

Chætetes corticans, Nicholson, Quart. Jour. Geol. Soc., XXX, 512, 1874; Pal. Ohio II, 210, 1875.

Atactopora hirsuta, Ulrich, Jour. Cin S Nat. Hist. II, 120, 1879; VI, 245, 1883.

A. maculata, Ulrich. Ibid, II, 121, 1879; VI, 246, 1883.

Spatiopora tuberculata, Ulrich. Ibid, VI, 166, 1883.

S. montifera, Ul. Ibid, VI, 168, 1883.

Corallum parasitic, forming a more or less extensive crust, from one-fourth of a line to two lines thick, ordinarily about one-half a line, attached to the outer surfaces of shells of *Orthoceras* and *Endoceras*. Surface with a number of long and narrow or rounded monticules, arranged with more or less regularity in diagonal lines, and with their longer diameter in the same direction as the long axis of the shell upon which they grow; summits generally compact. Calices small, polygonal, nearly equal in size, with occasionally a few interstitial corallites. Walls of calices rather thick at the surface, thinner beneath, sometimes bearing on their margins one or two rows of minute tubercles.

Obs.—As shown by the synonomy, this species has been described under various names. *Atactopora hirsuta* and *A. maculata* are names given to two forms, one bearing two rows of spines and the other a few only on the edges of the calices; they also have rather rounded monticules. In speaking of the figures of these two species, their author says: "Comparing figure 2 with figure 1, both representing tangential sections, . . . we find that with the exception of the relative thickness of the cell interspaces or walls, the two species are precisely alike. In both we find the same peculiarly constructed 'maculæ,' while in the minute structure of the cell walls, no difference whatever is apparent. In their vertical sections a corresponding agreement of structure is apparent."[*] The species is mainly recognized by the well developed, elongated monticules.

Formation and Locality.—Lower Silurian, Cincinnati Group, from the lowest rocks at Cincinnati to the highest beds in Warren, Clinton and Butler Counties, O.

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[*] Jour. Cin. S. N. H. VI, 246.

43.—M. ORTONI, Nicholson.

Monticulipora (?) *ortoni*, Nich. Whitfield Geol. of Wisc. IV, 251, 1882.

M. (*Peronopora*) *ortoni*, Nich. Genus Montic., 228, 1881.

Chætetes ortoni, Nich. Quar. Jour. Geol. Soc. XXX, 513, 1874; Pal. Ohio, II, 211, 1875.

Atactopora ortoni, Ulrich. Cat. Fos. Cin. Gr., 13, 1880; Jour. Cin. S. Nat. Hist., II, 120, 1879; VI, 246, 1883.

Atactoporella ortoni, Ul. Ibid, VI, 248, 253, 256, 1883.

Atactopora multigranosa, Ul. Ibid, II, 122, 1879.

Atactoporella multigranosa, Ul. Ibid, VI, 254, 1883.

Atactopora mundula, Ul. Ibid, II, 123, 1879.

A. tenella, Ul. Ibid, II, 123, 1873.

Atactoporella mundula, Ul. Ibid, VI, 252, 1883.

A. schucherti, Ul. Ibid, VI, 251, 1883.

Corallum forming a very thin crust parasitic on shells of *Orthoceras*, *Strophomena*, and fronds of various corals, varying from one-ninth to three-fourths of a line thick, and rarely more than one inch in diameter. Surface with numerous rounded or conical monticules, more or less regularly distributed, from one-half a line to a line or more apart, and either solid or bearing calices of the ordinary size. Calices irregular in shape, often indented by one or more tooth like or blunt projections; margins varying in different examples from thin to very thick, and generally studded with small tubercles, giving the surface a granular appearance. Interstitial cells more or less numerous.

Obs.—The various forms of this species do not seem to present sufficient difference to justify regarding them as distinct species. One (*A. multigranosa*) has a thicker corallum than ordinary, and groups of larger sized tubes. In *A. mundula* the original description states that the walls are thick, the amended one (under *Atactoporella*) calls them thin. Lastly, *A. schucherti* differs in having more prominent spiniform corallites. All these are small differences. The species can be mainly recognized by its limited extent, the regular arrangement of the rounded monticules, and the indented calices.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati, Oxford, Ohio, etc. Hudson River Group of New York Delafield, Wisc.

44.—M. PAPILLATA, McCoy.

Edw. & Haine, Brit. Foss. Cor., p. 266, 1850.

Nebulipora papillata, McCoy. Ann. & Mag. Nat Hist. ser. 2, VI, 248, 1850; Brit. Pal. Foss., p. 266, 1850.

Chætetes tuberculatus, Ed. & H. Pol. Foss. des Terr. Palæ.

Chætetes papillatus, McCoy. Nicholson, Pal. Ohio II, 210, 1875.

Monticulipora parasitica, Ulrich. Jour. Cin. S. Nat. Hist., V, 238, 1882.

Corallum forming a thin crust, parasitic on shells of Brachiopods, Orthoceras, and other foreign bodies, generally about one-half a line thick. Surface with small, rounded monticules, arranged more or less regularly, and generally occupied by corallites of a larger size than the average. Calices polygonal, thin walled, bearing in well preserved examples a small number of spiniform corallites. No interstitial cells.

Obs.—The genus *Nebulipora*, McCoy, is undoubtedly a synonym for *Monticulipora*. The present species is recognized by the more or less regular arrangement of the rounded monticules and the polygonal calices.

Formation and Locality.--Lower Silurian, Cincinnati Group, Cincinnati and Hamilton, O.

45.—M. CRUSTULATA, U. P. James.

Nicholson, Genus Montic., 27, 1881.

Chætetes crustulatus, James. The Palæon., p. 1, 1878, p. 20, 1879.

Leptotrypa ornata, Ulrich. Jour. Cin. Soc. Nat. Hist., VI, 160, 1883.

L. clavis, Ul. Ibid, p. 161.

L. cortex, Ul. Ibid, p. 162.

Spatiopora aspera, Ul. Ibid, p. 166.

S. maculosa, Ul. Ibid, p. 167.

S. lineata, Ul. Ibid, p. 167.

Atactoporella typicalis, Ul. Ibid, p. 248.

Corallum forming a thin crust, parasitic on shells of *Orthoceras* and other substances, and from one-eighth of a line to one-fourth of a line thick. Surface generally smooth, sometimes with a few small elevations. Calices sub-polygonal, rounded or oblong, varying in form and size; at intervals of about two lines are groups of larger cells, sometimes the center one larger than the rest. Walls of corallites very thin, sometimes bearing numbers of spiniform corallites. No interstitial cells. (Plate 1, figs. 2, 2a.)

Obs.—This is mainly distinguished by the smooth or nearly smooth surface. It is similar to the following, from which, perhaps, it ought not to be separated. The species united above are all too indefinite in character to be recognizable, so they are all reduced to synonyms. In one the calices are arranged more or less regularly.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati and Hamilton, O., etc.

46.—M. WETHERBYI, Ulrich.

Jour. Cin. Soc. N. Hist., V. 239, 1882; 14th Ann. Rept. Geol. & N. H. Soc. Minn., 129, 1886.

Corallum forming a thin, irregular expansion on various foreign bodies, with the center sometimes slightly elevated. Surface sometimes nearly smooth, but often raised into low monticules, which are occupied by larger cells; in the nearly smooth forms these occupy patches scattered irregularly over the surface. Calices polygonal, with thin walls. Prominent spiniform corallites occupy the angles of the cells in well preserved specimens.

var. ASPERULA, Ulrich.

Petigopora asperula, Ul. Ibid, VI, 157, 1883; 14th Rept. G. & N. H. Sur. Minn., 130, 1886.

Differs from the type merely in being sub-circular in outline, and being generally attached to the shells of *Strophemena alternata*. It approaches quite closely to *M. petechialis*, Nich., but differs in being larger and having more prominent monticules.

Obs.—In this species and variety we have an example of what is spoken of under *M. petechialis*, Nich., namely, that probably the smaller forms are merely the younger individuals. The close resemblance between this species and its variety would seem to indicate the trnth of the idea. In both the monticules are only slightly raised, and have larger cells than the average. Both have numbers of spiniform corallites, and both are found at the same horizon.

Formation and Locality.—Type form, Lower Silurian, Trenton Group at High Bridge, Ky., and Chazy (?) Group at Minneapolis, Minn. Variety, Trenton Group, Minneola, Minn., Cincinnati Group, Cincinnati, O.

47.—M. PETECHIALIS, Nicholson.

Chætetes petechialis, Nich., Pal. Ohio II, 213, 1875.

Petigopora petechialis, Ulrich. Jour. Cin. S. N. Hist., VI, 156, 1883; 14th Rept. Geol. & N. H. Sur. Minn., 103, 1886.

Corallum forming small circular patches, from less than one-half a line to a line and one-half in diameter, attached parasitically to foreign bodies, generally the shells of brachiopods (*Strophomena alternata*, etc.) More or less convex above. Surface generally smooth, but often with a single central elevation. Calices subcircular, mostly equal, with moderately thick walls. No interstitial cells.

Obs.—This is a peculiar little species, which can scarcely be mistaken for any other. It is questionable whether it may not be the base of some other species, possibly the young corallum of some encrusting form like *M. papillata*. Nicholson, indeed, makes such a suggestion, but does not think it likely. He says, further, that "at any rate, in the absence of any specimen by which this could be directly connected with any other known form, I have thought it best to place it under a separate title, since it is not only common in its occurrence, but is also very constant in its size and other characters."*

Formation and Locality.—Lower Silurian, Trenton Group, Kentucky and Minnesota; Cincinnati Group, at Cincinnati, O.

48. M. DYCHEI, U. P. James.

Monticulipora (Monotrypa) dychei, James. The Paleont., 52, 1882.

M. dychei, James. Jour. Cin. S. Nat. Hist., VI, 235, 1883.

Corallum sub-fusiform in outline, parasitic on a crinoid column, with rough, nodular swellings, low ridges and annular constrictions. Surface with slightly raised, rounded monticules, irregularly distributed over the surface, and occupied by calices slightly larger than the average. Calices polygonal; walls of cells thin and sharp; interstitial tubes wanting.

Obs. This species is one easily recognized by the peculiar form, and its place of growth. The crinoid stem upon which the corallum grows is easily seen at either end. The type specimen is seven inches long, and tapers both ways from a diameter of two inches to but little more than the size of the crinoid stem.

Formation and Locality. Lower Silurian, Cincinnati Group, Upper beds at Cincinnati and Lebanon, O.

49. M. CLAVACOIDEA, U. P. James.

Monticulipora (Monotrypa) clavacoidea, James. Nicholson, Genus Montic., 182, 1881.

Chaetetes clavacoideus, James. Cat. Low. Sil. Foss. Cin. Gr.

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* Op. cit., p. 223.

(named but not figured or described), 1871. Cat. Low. Sil. Foss. 2d Ed., p. 1, 1875.

Leptotrypa clavacoidea, Ulrich. Jour. Cin. S. Nat. Hist. VI, 159, 1883.

L. minima, Ul. Ibid, VI, 159, 1883.

Corallum cylindrical, clavate or fusiform, receiving its form from the tapering ends of small species of Orthoceras, or other cylindrical objects, to which it is generally attached by the whole of the base. Surface either smooth or elevated into low monticules, occupied by tubes slightly larger than the average. Calices polygonal, nearly equal in size. Walls of corallites thin. No interstitial cells.

Obs. This species is easily recognized by its peculiar shape. Sometimes the object upon which it is grown has decayed, and the hollow is filled with clay, or it remains hollow.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati, O.

50. M. FUSIFORMIS, Whitfield.

Chætetes fusiformis, Whitf. Ann. Rept. Geol. Sur. Wisc , for 1877, p. 70; Geol. of Wisconsin, IV, 248, 1882.

Monticulipora (*Monotrypa* (*?*) *subfusiformis*, U. P. James. The Palæon., 52, 1882.

Corallum cylindrical, sub-fusiform, straight or curved, pointed or blunt at one or both ends; a few specimens with a projection at one end, but not like a base; one-fourth of an inch to an inch long, and from one-half a line to one and one-half lines in diameter. Surface smooth. Calices very small, oval or sub-circular, without any regular arrangement. Intercellular spaces marked by scattered pits or a depressed groove or an elevated ridge-like line. Walls of cells tolerably thick.

Obs.—Differing from *M. clavicoidea* in the smaller size and apparently free habit not incrusting shells of *Orthoceras* (*?*).

Formation and Locality.—Lower Silurian, Hudson River Group, Iron Ridge Wisc. Cincinnati Group in Warren and Clinton Counties, O.

51. M. HOSPITALIS, Nicholson.

Monticulipora (*Prasopora*) *selwynii*, var *hospitalis*, Nich. Genus Montic. 209, 1881.

Prasopora hospitalis, Ul. Jour. Cin. S. N. Hist. V, 237, 1882.

Monticulipora (*Heterotrypa*) *winchelli*, U. P. James. The Palæon. 48, 1882.

Corallum hemispheric, rarely globular, eight to ten lines in diameter, from three or four to seven or eight lines high. Surface smooth. Calices of two kinds, the larger oval or circular, the smaller sub-angular, wedged in between the larger ones, occasionally aggregated into star-shaped maculæ. Spiniform corallites numerous.

var. LÆVIS Ulrich.

Monticulipora lævis, Ul. Jour. Cin. Soc. Nat. Hist. V, 236, 1882.

Differs in the cells being generally nearly equal, and polygonal instead of oval or circular.

var. NEGLECTA, n. var.

Corallum irregularly conical; surface with many prominent monticules, about one line apart. Calices equal in size, sub-polygonal. Corallites take a direct course from base to appex. (Plate 1, fig. 3).

Obs. The type form was regarded, as seen above, by Dr. Nicholson as a variety of *selwynii.* It differs from that, however, in being parasitic, or at least attached. *Selwynii* was a free form. Variety *neglecta* differs mainly in possessing conspicuous monticules.

Formation and Locality.—Lower Silurian, Cincinnati Group, Cincinnati. Waynesville, Ohio, &c.

GROUP VI. Species imitating foreign bodies.

52 M. CALCEOLA, Miller & Dyer.

Jour. Cin- S. N. Hist. I, 26, 1878.

Monticulipora, (*Monotrypa*) *calceola*, M. & D. Nicholson, Genus Montic. 185, 1881.

Leptotrypa calceola, Ulrich. Jour. Cin. S. N. Hist., VI, 159, 1883.

Corallum free, of rather small size, helicoid in form, and varying from one line to six lines in diameter. Surface smooth or covered with low rounded monticules. Interior traversed by a horn shaped cavity lined on the inside by encircling striæ, and varying from one-half a line to more than two lines in diameter. Calices variable in size, polygonal, more or less regularly arranged. Walls thin.

Obs.—This peculiar species is easily recognized from its shape. It was originally compared to the "shape of a little wooden shoe." In the original description an account of how its form might have arisen is given. The authors suppose it to have begun from an embryo or a cilated animalcule floating free in the water, and giving rise to a colony by generation from either side and from one end, leaving the other as a central tube or cavity. Nicholson, among others, considers it to have taken its form from something inherent in itself, and not due to growing around any other object.

Formation and Locality.—Lower Silurian, Cin. Group, Cincinnati, Ohio.

Sub genus A.

DEKAYIA, Edw. & Haime, 1851.

Pol. Foss. des Terr. Pal. 277 p. 1851; Nicholson, Pal. Tab. Cor., 291, 297, 1879. The Genus Montic., 98,. 1881 Ulrich, Jour. Cin. S. N. Hist. V, 155, 1882; VI, 148, 1883.

Dekayella Ulrich. Jour. C. S. N. H., V, 155, 1882; VI, 90, 1883.

Corallum branching, with corallites of two kinds, the smaller isolated by the larger tubes. Large calices polygonal, thin walled. Small ones with thickened walls, and with conspicuous, blunt, spine-like processes at the angles of junction of the larger tubes.

This sub-genus can only be separated from *Monticulipora* by the surface columns, which constitute a marked feature of the exterior.

53 M. (DEKAYIA) ASPERA. Ed. & H.

Pol. Foss, des Terr. Pal. 277, 1851.

Dekayia attrita, Nicholson. Pal. Tab. Cor. 298, 1879; Ann. Nat. Hist. ser.,4, XVIII, 93, 1876.

Chætetes attritus, Nicholson. Quart. Jour. Geol. Soc. XXX, 503, 1874; Pal. Ohio, II, 194, 1875.

Dekayia maculata, U. P. James. The Palæon. 36, 1881.

D. pelliculata, Ulrich. Jour. Cin. S. Nat. H. VI, 150, 1883.

D. trentonensis, Ul. Ibid, 151;
D. appressa Ul Ibid, 152;
D. paupera, Ul. Ibid, 153;
D. multispinosa, Ul. Ibid 154.
} 1883.

Corallum dendroid, branching dichotomously and frequently; branches small, from three to ten lines in diameter, sometimes flattened. Surface often with clusters of cells larger than the average scattered over the surface; monticules, when developed, occupied at the summit by small cells. Calices polygonal, in some cases covered with a pellicle which often hides the spinous processes. Spines generally conspicuous, developed at angles of junction of cells, and projecting as quadrangular processes above the general level. Interstitial cells more or less numerous.

Obs. This species seems to be a variable one. Certainly the forms described under different names are not sufficiently distinct to be recognized. Dr. Nicholson says of his *D. attrita*, that it "is very probably identical with the type species *D. aspera* Ed. & H."* Mr. Ulrich says in his remarks on the genus *Dekayia*, "On account of their simplicity of structure, inexperienced collectors will probably find some difficulty in distinguishing one from the other, [referring here to five new species he is about to name and describe]. It must, however, be borne in mind that the more simple these organisms are, the more important are their variations. In separating them from each other, the characters principally to be taken into consideration are the following: The growth of the zoarium [corallum]; the size of the cells, and the thickness of their walls; the presence or absence of small (interstitial?) cells,—and their distribution if present: the size and number of the spiniform tubuli [corallites]: and lastly the disposition and number of the diaphragms [tabulæ] crossing the tubes."† All these are too indefinite in character and too inconstant in occurrence to serve even for specific characters. His own remarks on *D. attrita*, will serve to illustrate this fact, and to show how the features change on different parts of the same corallum. "Until lately I was under the impression that Nicholson's *D. attrita* might be advantageously regarded as a distinct variety of *D. aspera*, but the material now at hand proves this view untenable. Dr. Nicholson's specimens undoubtedly represent the terminal branches of a typical example of Edwards and Haime's species, the branches of that portion of the zoarium [corallum] always being more strictly dendroid and of smaller size than the primary ones."‡

Formation and Locality. Lower Silurian, Trenton Group, Burgin, Ky. Hudson River Gr., Wisconsin. Cincinnati Gr., Cincinnati, Loveland, O., Covington, Ky., etc.

Sub-genus B.

CONSTELLARIA, Dana, 1846.

Expl. Exp. Zoophytes, 537, 1846. Nicholson Pal. Tab. Cor. 300, 1879; Genus Montic. 97, 1881; Ulrich, Jour. Cin. S. N. Hist. V, 155, 1882; VI, 265, 1883.

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*Pal. Tab. Cor. 298

†Jour. Cin S. Nat. Hist. VI. 149.

‡Ibid. VI. 149.

Stellipora, Hall. Palæont. N. York, I, 79, 1847. Ulrich, Jour. Cin. S. N. H. V, 155, VI, 265.

Corallum dendroid or incrusting, with the branches cylindrical, flattened or more or less frondose. Surface with more or less conspicuous star-shaped, depressed maculæ made up of small tubes surrounded by a variable number, (8 to 20) ridges, radiating outwards and carrying large tubes; occasionally nearly smooth. Calices oval or circular, with thick walls.

Obs.—Stellipora is an obvious synonym of *Constellaria*, having been described a year later.

54.—M. (CONSTELLARIA) POLYSTOMELLA, Nicholson.

Constellaria polystomella, Nich. Pal. Ohio, II, 215, 1875. Whitfield Geol. of Wis. IV, 257, 1882.

C. antheloidea, Nich. (*non* Hall) Pal. Ohio, II, 214, 1875. Edw. & H. (*non* Hall) Pol. Foss. des Terr. Pal, 279, 1851: U. P. James, The Palæont. 13, 1878: Nicholson, Ann. Nat. Hist. ser. 4, XVIII, 92, 1876: Pal. Tab. Cor. 301, 1879.

C. florida, Ulrich. Jour. Cin. S. Nat. Hist., V, 257, 1882; VI, 267, 1883.

var. *prominans*, Ul. Ibid, VI, 269.

var. *plana*, Ul. Ibid, VI, 269

Stellipora limitaris, Ul. Ibid, II, 126, 1879.

Constellaria limitaris, Ul. Ibid, VI, 269, 1883.

C. fischeri, Ul. Ibid, VI. 270, 1883.

Corallum forming palmate or sub-lobate, flattened expansions, or cylindrical stems, varying in height and thickness: generally from one and one-half lines to two lines thick, and composed of corallites radiating from an imaginary central plane in all directions to surface. Surface with numerous stellate areas, one line apart, consisting of a depressed central space, surrounded by from six to fourteen or more prominent and radiating ridges. Corallites of two kinds: the larger oval or circular, occupying the general surface of the corallum, and found especially on the ridges of the star-shaped monticules: smaller ones occupying inter-spaces between the larger ones, and especially the central depressed areas.

Obs. The var. *prominans* of *C. florida*, as above, is said to be chiefly characterized by its large and prominent monticules, while var. *plana* has a nearly smooth surface. The various forms are only variations of the type, and the remarks made by one of us in 1878 describes the various features the species presents.*

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*The Palæont pp. 13, 14. Somewhat changed in form.

The species is found in abundance and in great perfection in the vicinity of Cincinnati, and although thousands of fragments have been collected, no single, entire corallum has ever been found. The nearest approach to an entire specimen we have ever seen is in the collection of one of us, and it measures from the base to the ends of the branches, five and one-half inches; and across the top at the widest place about the same distance. From its broken condition as it lies on the slab it is evident that it grew in a bushy manner and was crushed when fossilized. The specimens as found assume a great variety of shapes, being palmate-digitate, flabellate, sub-frondose, cylindrical and sometimes amorphous. The upper and outer branches, shown to be such by the calices extending all around and over the ends, are smaller and more delicate.

The star-shaped monticules differ more on different specimens than do the shapes of the branches themselves. On the upper branches the rays are sometimes elevated into sharp spur-like points, at times extending nearly all around a cylindrical branch; or they gradually become less and less prominent till they sink to a level with the general surface, or are even depressed beneath it. The number of rays to the different stars varies from five or six to thirty, sometimes appearing like elevated ridges, two or three lines long, the rays forming spur-like projections on each side and end: others appear like annulations round the branches. The probabilities are that on the base and lower branches of this coral the star varied in shape and prominence from those on the upper parts.

One of us attempted to describe a new species from specimens bearing depressed stars, but after examining a great number of specimens he found they shaded off so into one another that it was impossible to draw a line between them, and was not able to find what seemed to be even a constant variety.

Formation and Locality.—Lower Silurian, Cin. Gr. Cincinnati, Clermont Co., etc O., Hudson River Gr., Delafield, Wisc.

55. M. (CONSTELLARIA) ANTHELOIDEA, Hall.

Stellipora antheloidea, Hall. Pal. N. Y., I, 79, 1847. Whitfield, Geol. Wisc, IV, 257, 1882. Ulrich, Jour. Cin. S. N. Hist., VI, 263, 1883, (*non* Nicholson, Pal Ohio and Pal. Tab. Cor.)

Corallum thin, parasitic on some foreign object, often a crinoid stem. Surface with star-shaped monticules, each composed of a central, generally depressed area, with from six to twelve elevated, more or less wedge shaped ridges, radiating outwards. Calices sub-circular, of two kinds, the larger on the ridges of monticules, the smaller in the depressed area's, sometimes granular.

Obs. The main difference between this and the preceding species is that this one is parasitic, while the other one has a ramose corallum. The monticules are similar as are also the calices. The name *antheloidea* has been generally though wrongfully given to the previously described form. Though in doubt as to the occurrence of *antheloidea* here, the description is inserted to direct attention to its parasitic habit. It may yet be found in our locality.

Formation and Locality.—Lower Silurian, Trenton Gr , New York.

Sub-genus. C.

FISTULIPORA, McCoy, 1849.

Ann. and Mag. Nat. Hist., ser. 2, III, 130, 1849. Nicholson, Pal. Tab. Corals, 304, 1879. Ulrich, Jour. Cin. Soc. Nat. Hist. V, 156. 1882.

Callopora, Hall. Pal. of New York, II, 144, 1852. Nicholson *l. c.*, 304, 1879. Ulrich, *l. c.*, V, 154, 1882.

Didymopora, Ul. Jour. Cin. Soc. Nat. Hist., VI, 156, 1882.

Calloporella, Ul. Ibid, V, 154, 1882.

Eridopora, Ul. Ibid, V, 137, 1882.

Leioclema, Ul. Ibid, V. 154, 1882.

Crepipora, Ul. Ibid, V. 157, 1882.

Cheiloporella, Ul. Ibid, V, 157, 1882.

Homotrypella, Ul. 14th Ann. Rept. Geol. and Nat. Hist. Sur. Minn. 83, 1885.

Corallum ramose or incrusting. Corallites of two kinds, larger ones oval or circular, often with oblique apertures, surrounded by small, interstitial cells in one or two rows, the apertures generally angular. Maculæ, if present, generally made up of smaller corallites than the average. Interstitial tubes often closed by thin, calcareous membrane. Walls of calices generally thin.

Obs. Though rather ill-defined, the species of this sub-genus can be recognized by the larger cells being surrounded by the smaller ones. There is great variation in the form of the corallum, even in what seems to be the same species; the forms vary from ramose, to irregular frondose masses and are also incrusting. The species placed in the sub-genus resemble in most essential features *Monticulipora*, so that the two cannot, without violence, be separated.

In part first of this paper (Vol. X. pp. 134, 140, this JOURNAL) *Crepipora* was placed as a synonym under Ceramopora : while *Cheiloporella* was placed as synonym under Monticulipora proper. At the present writing we consider them more properly placed under Fistulipora as above.

KEY TO SPECIES.

a. Corallum ramose, cylindrical, or lobate.
  * Monticules or maculæ made up of many minute tubuli 56
  *Maculæ made up of few tubuli...... 57
  *Maculæ wanting.
    † Calices circular, oblique.......... 59
    † Calices elevated, arranged in lines........... 58
b. Corallum incrusting.
  * Calices circular, oblique....... 59
  * Calices oval, with a distinct ring like wall..........60

56. M. (FISTULIPORA) VENUSTA, Ulrich.

Chætetes venustus, Ul. Jour. Cin. S. N. Hist. I, 93, 1879.

Crepipora venusta, Ul. Ibid, V, 257, 1882.

Chætetes granuliferous, Ul. Ibid, II, 128, 1879.

Homotrypella granuliferous, Ul. 14th Rept. G. and N. Hist. Sur. Minn. 83, 1886.

Corallum dendroid, branching at variable distances; branches generally hollow, the inner surface lined with an epithecal membrane; varying from two to ten lines in diameter, and sometimes irregularly thickened or nodulated. Surface nearly smooth, sometimes with low, rounded monticules, the summits occupied by thirty or more minute tubuli; Sometimes depressed instead of elevated. Calices varying in size and form, circular, oval, sub-polygonal or rhomboidal. Interstitial spaces thin or thick, with few interstitial corallites.

Obs.—This species was referred by one of us to *Callopora* in our collection as a new species, but Mr. Ulrich's name has precedence. From the hollow branches, with a strongly wrinkled dermatic crust, and the peculiar feature of the minute tubuli occupying the center of the monticules, it seems readily distinguished. The variation presented by thin or thick intercellular spaces we regard as due merely to weathering, and to show this is not unlikely we refer to remarks upon *M.* (*F.*) *nicholsoni*, (No. 59).

Formation and Locality.—Lower Silurian, Trenton Gr., Kentucky, Cincinnati Gr., Covington and Frankfort, Kentucky, and Cincinnati, O.

57. M. (Fistulipora) oweni, U. P. James.

Fistulipora oweni, James. Jour. Cin. Soc. Nat. Hist. VII, 21, 1884.

Corallum in flat, twisted expansions, one-half a line to one line in thickness, sometimes lobate, or in sub-cylindrical, hollow tubes. Surface with clusters of eight or ten projecting apertures, sometimes regularly and again irregularly arranged. Maculæ about one line apart, and about one-half a line across; interstitial spaces occupied by small pores. Corallites springing from a delicate striated epitheca. Calices sub-oval, or sub-circular. Walls thin, but thicker on one side than on the other. Tubes slightly curved at the base, then vertical to the surface.

Obs. This species, though similar in some respects to the preceding, can be separated from it by the twisted corallum, and by the maculæ being made up of from but eight to ten tubuli instead of a considerable number, sometimes thirty.

Formation and Locality—Lower Silurian. Cincinnati Group, Lebanon, Ohio.

58. M. (Fistulipora) alternata, U. P. James.

Ceramopora alternata, James. The Palæontologist, p. 5, 1878.

Corallum forming branching cylindrical or compressed, generally hollow stems, one to four lines in diameter, often filled with clay or some other foreign substance. Surface sometimes with slightly elevated spots, bearing few cells, and a greater or less number of smaller pores. Calices in perfect specimens sub-circular or oval, elevated, and slightly oblique or arched; generally arranged in alternating, but sometimes in diagonal rows around the branches. Interstitial pores numerous on worn specimens. (Plate 1, figs. 5, 5*a*.*b*).

Obs. This species may generally be recognized by the maculæ when present, being made of both large and small tubuli. The apertures, too, are slightly arched, and arranged in lines or rows round the branches.

Formation and Locality.—Lower Silurian, Cin'ti Groups, Cincinnati, O.

59. M. (Fistulipora) nicholsoni, U. P. James.

Cerampora nicholsoni, James. Cat. Foss, Cin. Group, p. 3, 1875.

Callopora cincinnatiensis, Ulrich. Jour. Cin. Soc. Nat. Hist., I, 93, 1878. The same with query (?). Ibid., V, 142, 1882.

Fistulipora (?) *multipora*, U. P. James. The Palæonlologist, p. 2, 1878. Supplement to Cat. Foss. Cin. Gr., p, 10, 1879.

F. *flabelletta*, Ulrich. *l. c.* II, 28, 1879.

Cheloporella flabellata, Ul. Ibid., V. 257, 1882.

Fistulipora siluriana, U. P. James. The Palæont, p. 19, 1879.

Corallum incrusting, or forming more or less branching or frondose masses; cells in a perfect condition, slightly oblique, with thin walls, but in many specimens direct to the surface, elevated like a ring, and surrounded by from one to two rows of interstitial cells. Ordinary calices circular or oval; the interstitial cells often polygonal. Walls thin or thick according to the condition of the specimen. (Plate 1, Figs. 6, 6 *a*, *b*, *c*).

Obs. This species is one which seems to appear under many forms. Those best known, or at least most common, have direct cells, with thin walls and these are surrounded by numerous small cells in one or two rows. One specimen of the species is very instructive. It is small (Plate I, fig. 6), about an inch in length, spreading out to about half an inch at the broader end, and has at one end circular calices, with thick interspaces, and the wall raised up to form a ring. Toward the center of the specimen the spaces between the cells become filled with cells. Further on the small cells become larger and more irregular, and finally at the end the apertures become oblique to the surface, the walls are thin and sharp, the calices are oval, and a very few interstitial cells can be seen.

It would appear that in a perfect condition the apertures are thin walled and oblique. When they are worn a little the sharp edges disappear, numerous interstitial cells appear, and the openings are direct. Finally, still further wear obliterates the mouths of the smaller cells, the larger ones appear to project above the surface, and the intercellular spaces are solid. All these features showing in a single specimen should make us cautious about describing new species of these forms. The four species united above have been considered distinct. Thorough investigation proves the untenableness of the view. We regard *cincinnatiensis* and *flabellata* as characterized upon slightly worn specimens, showing a great number of interstitial cells. *Multipora* represents another phase, less worn than the preceding, with the interstitial cells irregular in form, while *siluriana* represents the same species when it is most worn and shows the thick intercellular spaces and the small number of interstitial cells. (See also remarks upon *Ceramopora ohioensis.* Nicholson).

Formation and Locality.—Lower Silurian, Cin. Gr., Cincinnati, O.

60. M. (FISTULIPORA) MILFORDENSIS, U. P. James

Callopora milfordensis, James. The Palæontologist., p. 11, 1878.

Corallum incrusting, often found on crinoid stems, one-fourth to one-half a line thick. Calices oval or sub-polygonal, without any apparent arrangement. Walls of calices elevated, sometimes in contact sometimes distinct. When distinct the interspaces filled with small, irregular shaped pores. (Plate 1, Figs. 7, 7 *a*, *b*).

Obs.—This species is closely allied to some forms of the preceding, but seems to be constant in the oval calices, with the ring-like wall. It may have to be united to *nichoisoni* eventually.

Formation and Locality.—Lower Silurian, Cin. Gr., Milford, (Hamilton Co),and Clermont county, O.

Genus 2. CERAMOPORA, Hall, 1852.

Palæont. of New York, vol. II, p. 168. Ulrich. Jour. Cin. Soc. Nat. Hist., V, 156, 1882.

Crepipora, Ulrich. Ibid, V, 157, 1882.

"Coral incrusting, or in flattened hemispheric forms: cells arranged in alternating or imbricating series; apertures arching or triangular, with apex above." (Hall).

Obs. This description, although short, is sufficiently clear for recognition, and has not been amended in any way since its first appearance. If accepted in its strict sense, as it will be here, it includes but few species although quite a number have been referred to it. It may possibly be better to so enlarge it as to include ramose forms, one of which at least seems referable here. Those which follow are all as yet that we have found which seem possibly referable to it.

The genus was considered by Prof. Hall as one of the Bryozoa [Polyzoa], and has been so regarded by most of those who have since written upon it. As it has seemed to us to be more closely allied to *Monticulipora*, than to any genus of Polyzoa, we have included it in this monograph. The presence of a longitudinal septum, as shown in worn examples of *M. ohioensis*, dividing the the cell into two parts is not known, we believe, in the Polyzoa, but such septa are present in many Cœlenterata. It may be that the genus will be removed eventually from the Monticuloporoid alliance and placed in some other one of the Cœlenterata, but we think without doubt its final position will be there rather than with any class of the Polyzoa. Septa of a similar kind to those in *M. ohioensis*, are found in *M.* (*Fistulipora*) *alternata*, described above.

1. C. OHIOENSIS, Nicholson.

Palæont. of Ohio, II, 265, 1875.

Corallum "incrusting, forming thin expansions attached to the surface of brachiopods or corals, and consisting typically at any rate, of a single layer of oblique cells. Cells arranged in intersecting diagonal lines, and disposed in a somewhat concentric manner round more or fewer central points: their upper walls thin and arched; the cell-mouths oblique, and, when perfect, semicircular in shape. About eight cells in the space of one line" (Nicholson.)

Obs. This species is a well marked one. and when found in a perfect condition can be very readily recognized. In many cases, however, the surface of the fossil is more or less abraded and worn, and then it presents an entirely different aspect. Dr. Nicholson in speaking of worn examples says that when only slightly worn the cell cavity appears to be divided into two compartments, each of a triangular shape, by means of an internal septum, while smaller cavities appear in the walls between the cells. When still more abraded, the cells have rounded or oval apertures, are arranged in diagonal rows, and "separated by a vast number of small rounded foramina, which appear to be the mouths of interstitial tubuli." When in this condition the species might be readily mistaken for a *Monticulipora*, especially the sub-genus *Fistulipora.*

Formation and Locality. Lower Silurian, Cin'ti Gr., Cincinnati, O.

2. C. BEANI, U. P. James.

The Palæontologist, p. 5 1878. (with a query (?)). Jour. Cin. Soc. Nat. Hist., VII, 23, 1884 (also with a query (?) as to the genus, and misspelled *Cerampora*).

(?) *Paleschara beani*, James. Ulrich. Am. Geologist, I, 186, 1888.

Corallum incrusting, forming thin, irregular expansions on shells of *Orthoceras*, and perhaps other bodies. Cells arranged in somewhat quincuncial order, in alternating, oblique rows, or at times irregular. Cell walls rather thick, with minute pores sometimes visible at the angles. Apertures oval, diamond-shaped or irregular, slightly oblique. Three cells to a line longitudinally, four or five transversely.

Obs. This differs from the preceding in the larger size of the cells, and the less regular arrangement. It seems to be almost invariably found on *Orthoceras*.

Formation and Locality. Lower Silurian, Cin'ti Gr., Warren Co., Ohio.

3. C. CONCENTRICA, U. P. James. The Palæontologist, p. 5, 1878.

Corallum forming simple crusts, or cylindrical or flattened branches, two to five lines in diameter, made up of concentric layers, each one-quarter to one-half a line thick: the incrusting forms growing on crinoid stems or other substances. Surface generally with maculæ, two lines apart from centre to centre, occupied by from four to six tubes, spreading in different directions. Calices circular or oval, often arranged in short alternating series. Apertures raised and arched. Walls rather thick, the margins often raised and thin and sharp. In worn specimens interstitial cells are shown. (Plate 1, Figs. 8, 8 *a*).

Obs. Thsi species may generally be recognized by the regular arrangement of the cell apertures, which spread in all directions generally from the centre of one of the maculæ. It somewhat resembles in this respect *Monticulipora rectangularis*, Whitf., from Wisconsin, but differs from that in the circular or oval cells.

Formation and Locality. Lower Silurian, Cin'ti Group, Cincinnati, O.

4. C. (?) WHITEI. U. P. James.

The Palæontol. (without ?) p. 12, 1878.

Corallum incrusting various objects, generally corals, forming masses three by six inches, more or less. Surface with slightly elevated areolæ, these cells smaller than the general average. Calices circular or oval to triangular, &c., varying also in size. Apertures slightly elevated and oblique, but mostly direct. Walls very thin. A few interstitial cells between some of the larger cells. (Plate 1, Figs. 9, 9 *a*.)

Obs.—This form is placed in the genus *Ceramopora* provisionally only. It presents many features of a typical *Monticulipora*, and perhaps should be placed there. The clusters of smaller cells together with the thin walls seem chiefly to distinguish it.

Formation and Locality.—Lower Silurian, Cincinnati Groups, Cincinnati, O.

CROSS-REFERENCE INDEX TO SPECIES AND SYNONYMS.

MONTICULIPORA, proper.

andrewsii (Heterotrypa) = *æqualis*, (*Monotrypella*).
pulchellus (*Chætetes*).
(Callopora)=Nich. non Ed. & H.
æqualis (*Monotrypella*)=andrewsii.
approximata (*Chætetes*)=ramosa var., dalii.
areolata (*Aspidopora*)=elegans
aspera (*Spatiopora*)=crustulata.
asperula (*Petigopora*)=wetherbyi, var. asperula.
briarea (Chætetes).
(Monotrypa)
(Monotrypella).
calceola (Monotrypa).
(Leptotrypa).
calycula (Lichenalia?).
(Chætetes?).
(Diplotrypa).
(Prasopora).
cincinnatiensis (Chætetes) *consimilis*.
(Peronopora) *nodosa* (*Prasopora*).
circularis (*Heterotrypa*)=lens.
cingulata (*Amplexopora*)=meeki.
clavacoidea (Chætetes) =*minima* (*Leptotrypa*)
(Monotrypa).
(Leptotrypa).
clavis (*Leptotrypa*)=crustulata.
clevelandi (Heterotrypa).
clintonensis (Heterotrypa).
communis = *o'nealli*, var. *communis* (*Heterotrypa*).
subplana (*Callopora*).
compressus (*Chætetetes*)
(*Peronopora*) = frondosa.
cortex (*Leptotrypa*) = crustulata.
corticans (*Chætetes*) = tuberculata.
conoidea (*Prasopora*) = whiteavesii.
consimilis = cincinnatiensis.
contigua (*Prasopora*) = newberryi.
crustulata (Chætetes)= *aspera* (*Spatiopora*).
maculosa (*Spatiopora*).
lineata (*Spatiopora*).
clavis (*Leptotrypa*).
cortex (*Leptotrypa*).
ornata (*Leptotrypa*).
typicalis (*Atactopora*),

curvata (*Homotrypa*) = frondosa.
dalii (*Chætetes*) = ramosa.
dalii (*Chætetes*) = ramosa, var. dalii.
dawsoni (Heterotypa).
(Homotrypa).
delicatula (Chætetes) = *minutus* (*Chætetes*).
decipiens (*Chætetes*) = frondosa.
discoidea (Chætetes).
(Monotrypa).
(Amplexopora).
(Leptotrypa).
dychei (Monotrypa).
eccentrica (Heterotrypa?).
elegans (Chætetes).
(Discotrypa) = *arcolata* (*Aspidopora*).
falesi.
filiasa (Chætetes).
(Monotrypa).
fletcheri (Nich., non Ed. & H.) = ulrichi.
frondosa (Chætetes) (Peronopora) (Heterotrypa) { *compressus* (*Chætetes*), (*Peronopora*), *curvata* (*Homotrypa*), *decipiens* (*Chætetes*), *uniformis* (*Peronopora*),
fusiformis (Chætetes) = *sub-fusiformis* (*Monotrypa*).
gracilis (Chætetes).
(Heterotrypa).
(Batostomella).
gracilis, var. *meeki* = meeki.
harrisi (*Calloporella*) = lens.
hirsuta (*Atactopora*) = tuberculata.
hospitalis (*Prasopora*) = { *selwynii* var. *hospitalis*, (*Prasopora*), *winchelli* (*Heterotrypa*).
hospitalis, var. lævis = *lævis*.
var. neglecta.
implicata (*Chætetes*) (*Heterotrypa*) (*Batostoma*) = } jamesi.
infida (*Diplotrypa*) = whiteavesii.
irregularis (Chætetes).
(Monotrypa).
jamesi (Chætetes), (Heterotrypa), (Batostoma), = *implicata* (*Chætetes*), (*Heterotrypa*), (*Batostoma*).

kentuckensis.
lævis = hospitalis, var. lævis.
lens (Nebulipora),
(Fistulipora), = *circularis* (*Heterotrypa*),
harrisi (*Calloporella*).
lineata (*Spatiopora*) = crustulata.
maculata (*Atactopora*) = tuberculata.
maculosa (*Spatiopora*) = crustulata.
mammulata (Chætetes),
(Heterotrypa) = *molesta* (*Peronopora*).
meeki (Chætetes) = *gracilis*, var. *meeki*,
cingulata (*Amplexopora*),
robusta (*Amplexopora*).
minima (*Leptotrypa*) = clavacoidea.
minutus (*Chætetes*) = delicatula.
molesta (*Peronopora*) = mammulata.
montifera (*Spatiopora*) = tuberculata.
mundula (*Atactopora*)
(*Atactoporella*) = ortoni.
multigranosa (*Atactopora*)
(*Atactoporella*) = ortoni.
newberryi (Chætetes),
(Prasopora), = *contigua* (*Prasopora*),
(Callopora), *parasitica* (*Aspidopora*).
newportensis (Atactoporella).
nodosa (*Prasopora*) = cincinnatiensis.
nodulosa (Chætetes),
(Heterotrypa),
(Callopora).
obscura (*Dekayella*) = ulrichi.
ohioensis.
o'nealli (Chætetes),
(Heterotrypa) = *sigillariodes* (*Chætetes*),
(*Callopora*).
o'nealli, ? *var. communis* = communis.
ornata (*Leptotrypa*) = crustulata.
ortoni (Chætetes),
(Peronopora),
(Atactopora),
(Atactoporella)
= *multigranos* (*Atactopora*),
(*Atactoporella*),
mundula (*Atactopora*),
(*Atactoporella*),
tenella (*Atactopora*),
schucherti, (*Atactoporella*).
parasitica (*Monticulipora*) = papillata.
parasitica (*Aspidopora*) = newberryi.

papillata (Nebulipora),
(Chætetes) = *tuberculata* (*Chætetes*), Ed & H. (*pars*).
parasitica (*Monticulipora*). (*non Aspidopora*).

pavonia.

petasiformis, var. welchi = *welchi.*

petasiformis (Monotrypa).

petechialis (Chætetes),
(Petigopora).

petropolitana (*Chætetes*) = whiteavesii.

pulchellus, Nich.,
(*non* Ed. & H.) = andrewsii.

quadrata (Chætetes),
(Monotrypa),
(Monotrypella) = *rhombicus* (*Chætetes*),
subquadrata (*Monotrypella*).

ramosa (Chætetes),
(Heterotrypa),
(Callopora) = *dalii* (*Chætetes*).

ramosa, var. rugosa,
(Callopora) = *rugosa* (*Chætetes*),
(*Heterotrypa*).

ramosa, var. dalii, = *dalii* (*Chætetes*),
approximatus (*Chætetes*).

rhombicus (*Chætetes*) = quadrata.

robusta (*Amplexopora*) = meeki.

rugosa (Chætetes),
(Heterotrypa) = ramosa, var. rugosa.

schucherti (*Atactoporella*) = ortoni.

sigillariodes (*Chætetes*),
(*Callopora*), = o'nealli.

simulatrix (*Prasopora*) = whiteavesi.

selwynii, var. *hospitalis*,
(*Prasopora*), = hospitalis.

selwynii (*Prasopora*) = whiteavesii.

septosa (Atactopora),
(Amplexopora).

subfusiformis (*Monotrypa*) = fusiformis.

subglobosa (*Chætetes*) = turbinata.

subplana (*Callopora*) = communis.

subquadrata (*Monotrypella*) = quadarta.

subpulchella (Chætetes),
(Heterotrypa).

tenella (*Atactopora*) = ortonii.

tuberculata (Chætetes), (Monotrypa), (Spatiopora) = {
corticans (*Chætetes*),
hirsuta (*Atactopora*),
maculata (*Atactopora*),
montifera (*Spatiopora*).

tuburculata (*pars*)=papillata.

turbinata (Chætetes).= {
subglobosa (*Chætetes*) (*Monotrypa*).
undulata (*Monotrypa*) *pars*.

typicalis (*Atactoporella*)=crustulata.

ulrichi (Heterotrypa) (Dekayella) = {
fletcheri, Nich. (*non* Ed & H).
obscura (*Dekayella*).

uniformis (*Peronopora*)=frondosa.

undulata (Chætetes).
(Monotrypa).

undulata (Pars)=turbinata.

varians (Chætetes).

vaupeli

welchi (*Monotrypa*)=petasiformis, var., welchi
wetherbyi.

wetherbyi, var., asperula=*asperula* (*Petigopora*).

winchelli (*Heterotrypa*)=hospitalis.

whiteavesii (Diplotrypa)= {
petropolitana (*pars*).
selwynii (*Prasopora*).
simulatrix (*Prasopora*).
conoidea (*Prasopora*).
infida (*Diplotrypa*).

whitfieldi.

wortheni.

Subgenus DEKAYIA.

attrita (*Chætetes*)=aspera.

appressa=aspera.

aspera= {
attrita (*Chætetes*).
appressa.
maculata.
multispinosa.
paupera.
pelliculata.
trentonensis.

maculata
multispinosa
pelliculata
paupera
trentonensis
= } aspera.

Sub-genus CONSTELLARIA.

antheloidea, Hall.
(*non* Nich).
(Stellipora).

antheloidea, Nich (*non* Hall)=polystomella.

fischeri
florida
florida, var., *plana* = polystomella.
var. *prominans*
limitaris (*Stellipora*)

antheloidea, Nich, *non* Hall,
fischeri,
polystomella= *florida*, var. *plana*,
var. *prominans*,
limitaris (*Stellipera*).

Sub-genus FISTULIPORA.

alternata.
(Ceramopora).

Cincinnatiensis, Ul. (non James)=nicholsoni.
(*Callopora*).

flabellata, =nicholsoni.

granuliferus,
(*Chætetes* =venusta.
(*Homotrypella*)

milfordensis.
(Callopora).

multipora=nicholsoni.

cincinnatiensis, Ul.
non James.
nicholsoni= *multipora*.
flabellata.
situriana.

oweni

siluriana=nicholsoni.

venusta=*granuliferus*.
(Crepipora).

Genus. CERAMOPORA.

beani.
concentrica.
ohioensis.
whitei.

The genus *Crateripora* was first described by Mr. Ulrich in the Journal of the Cincinnati Society of Natural History, Vol. II, p. 29, April, 1879, and two species and a variety were there characterized. There were *C. lineata*, and var. *expansa*, and *C. erecta*. The first of these had been described a few months before (January, 1879), by one of us as *Sagenella striata*. (The Palæontologist, p. 22). The author of the genus abandoned it at a later period, 1882, stating (J. C. S. N. H. V, 151.) that the forms "are now known to be attached bases of the *Ptilodictyonidæ*. The form described as *C. lineata*, and var. *expansa* belong to species of *Ptilodictya*. The bases of *Arthropora* were called *C. erecta*."

These facts are mentioned here so that future students may know how *Crateripora* is now regarded.

The following species of the group of Monticulporoids are either too ill defined or too obscure to find a place in the body of the paper.

Homotrypa obliqua. Ul. Jour. Cin. Soc. N. Hist. V, 343.

Petigopora gregaria, Ul. Ibid, VI, 155,

The one following has been described as a *Ceramopora*, but it is apparently a polyzoan, so it is omitted. We refer to *C. radiata*, U. P. James. The Palæont, p. 12, 1878.

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REPORT OF THE EXECUTIVE BOARD

Read at the Society's Annual Meeting, April 3, 1888, and ordered printed in the JOURNAL.

To the Cincinnati Society of Natural History:

By Section 7 of Article 11 of the By-Laws, it is made the duty of the Executive Board that "they shall annually report to the Society the condition of the Museum and Library." In obedience the following is respectfully submitted:

The collections of the Museum have increased until much valuable material has to be stored away, for which reason it cannot be displayed or arranged so as to be made conveniently useful. The Botanical collection is quite full, but needs the flora of our own immediate vicinity and region. The valuable collection in Palæontology is being increased, chiefly from the Carboniferous and Tertiary geological formations. No important advance has been made in mineralogy.

In Conchology 500 species have been added, during the year, 400 of which are new. The growth this year in this branch has been through exchanges made by Mr. Horace P. Smith, your Custodian. In Zoology the collections are increasing, though slowly. In the department of Ornithology it has been advised by Mr. Wm. Hubbell Fisher, Dr. F. W. Langdon and Mr. Chas. Dury that attention be directed to the increase of the collection from the fauna of our region and vicinity. In Osteology, Ichthyology, and Anthropology in its archæological phase, little progress has been made. No increase has been made in the collection of Entomology.

The Board regrets that there has been for some time a falling off of the number of members who pursue specialties in the above-named or other departments. To such an extent has this arrived that there is a lack of scientific articles for the JOURNAL of the Society, which for many years caused it to rank in first class with the natural history scientific journals of this and foreign countries. It should be an object for the Society to increase its number of working specialists.

The Library of the Society is in a sound and flourishing condition. It numbers now something over 3,000 valuable books and pamphlets. It has been increased during the current year about 300, of which 160 have been exchanges for the JOURNAL of the

Society—valuable exchanges. This shows the importance of issuing a journal devoted to scientific articles, especially in the department of natural history belonging to our home locality.

Independently of the Museum, special work, and the JOURNAL, the Society is steadily making a healthy progress in public favor and usefulness in another and exceedingly valuable and interesting field of labor. Under a plan of action, due originally more to Prof. Joseph F. James than to any other individual, carefully fostered and extended by the Society, it has become a *free teacher* by the formation of lyceum classes and lectures. These have increased in kind and in the number of students. The Lyceum has 82 members, of which 70 per cent. have been constant in attendance on the lecture courses. These lecture courses commenced on the 17th of September, 1887. The first course had "*Physics*" for its subject of treatment, and the lectures were delivered by Mr. Horace P. Smith. The second course was on Chemistry, the lectures being delivered by Dr. W. S. Christopher. The third subject in course was Anatomy and Physiology, the lectures on which were delivered by Dr. B. Merrill Ricketts, assisted by Dr. Goode and Dr. W. R. Amick. It must be borne in mind that these lectures have been prepared and delivered by the free act of these gentlemen for the benefit of the Society and of the classes, they should therefore have the hearty thanks of the Society. The fourth course will be on Microscopy, by Dr. C. E. Caldwell, and the fifth and last will have Zoology for its subject, by Mr. Wm. Hubbell Fisher, assisted by Mr. Chas. Dury.

Beside the lecture course, the Woodward and Hughes High Schools have inaugurated the custom of sending pupils to the Museum to receive tuition in zoology through use of the animal objects themselves. Monday afternoons have been set aside for Hughes—and Tuesday afternoons for Woodward High School. Attendance from Woodward (voluntary) has been from 20 to 40 pupils; from Hughes (by order) about 100. It is to be hoped that these classes will be made permanent and regular, and the prospect is flattering for the reason that attendance will arise from a pleasurable inducement, combining the features of a holiday with those of useful instruction. It is likewise to be hoped that our Society may thus gather the like happy and busy throngs to be seen on public days in the great Museum in the city of New York.

The Society has also had its regular winter course of lectures, to the number of ten, at regular weekly periods, commencing Friday evening, January 6th, 1888. These lectures have been instructive and popular, the attendance proving too large for comfortable accommodation in our somewhat restricted quarters. It has been found that we have an abundance of excellent and superior talent to call on in our midst, and invitations to lecture by the Society have been most generously responded to. The thanks of the Society should be given to Mr. Charles B. Going, Mr. George Bullock, Dr. B. Merrill Ricketts, Prof. Joseph F. James, Prof. Amos R. Wells, Dr. D. S. Young, Mr. Chas. Dury, Dr. Walter S. Christopher, Dr. F. W. Langdon, and Dr. A. B. Thrasher for their services so cheerfully rendered, and for their able contributions to the entertainment and instruction of our townspeople.

With all the work of the Society in various ways, the exhibit as to its financial condition at this time, the close of our fiscal year, is good. At the opening of the year we had a balance over from the preceding year of $342 in the hands of our Treasurer of income appropriated to be applied to the current expenses of the Society. This year we have a balance over of something more than $989 to be passed over to the expenditure of the Society for the coming year. It perhaps might be a wise policy to set aside, say, the sum of $500 of this for a permanent investment to increase the endowment fund of the Society.

It is found, as said, that the Society is steadily growing in public favor, through its lyceum classes and its course of winter lectures, independently of its character as a grand Museum of Natural History, affording the means of scientific reference in all the departments thereof. The Society is becoming not only an honor to our town, but of comparative worth with those of the great cities. And this being so, we want more space for a better arrangement of our various branches of exhibition, and this *emphatically* in a *fire-proof structure.* We want a lecture-room equal to the popular growth of taste for delightful instruction in Natural History. We require class-rooms for special classes, and so on. It need not be held invidious to claim that a roomy, fire-proof building for a Museum of Natural History, with a commodious lecture-room and class-rooms, should be as much a need and pride of a great city such as ours, as is an Academy of Music, a Museum of Fine Arts, or even as a University or the High Schools themselves. And this is enforced when it is considered that the study of Natural History is an enticing pleasure and attractive to youth. They seek its fields eagerly from an inborn love of Nature and her workings; they love her simple and fascinating lessons with an appetite which continually grows by what it feeds on.

With us, here, tuition is free, our doors are open, and it affords as much pleasure to give instruction as it can to receive it. For these reasons let us unite to work as far as we can for the stated ends, the satisfaction of the needs or wants which we are now beginning to feel to be almost imperative.

Mr. Horace P. Smith, custodian of the Society, deserves commendation for the faithful administration of the duties of his office, and for his zealous efforts for the growth and successful conduct of the Lyceum classes.

THE EXECUTIVE BOARD.

IN MEMORIAM

WALTER ANGUS DUN

BORN MARCH 1 1857

DIED NOVEMBER 7 1887

WALTER ANGUS DUN.

Doctor Walter Dun died on the afternoon of November 7th, 1887, after a severe illness which continued for four weeks.

By his death the community lost a man of inestimable worth, and one who gave the most brilliant promise of future success and usefulness. Endowed with those rare qualities of mind and character which fit their possessor to fill the highest stations in life, few enjoy brighter prospects than he, and seldom is a death more deplored in a community than was his. All that may be said to honor his memory, is no more than would have received the hearty indorsement of every one who knew him, had it been spoken during his life. A man of more than ordinary ability and perseverance, upon whatever work he entered, it was with the purpose to carry it through to a successful issue. His mind was of unusual strength and acuteness, his reasoning and judgement clear and unbiased by prejudice or false ideas, he was broad and liberal in his views, but always a staunch adherent of truth and justice; his every action was based upon principle and not upon caprice.

He was an earnest student, not only in his professional work, but in many subjects of scientific or general interest. Into whatever circle he entered, literary, scientific, or professional he, received a warm welcome not only by reason of his attainments, but by his warm genial heart, and his manly unassuming character, which won for him a host of sincere friends. Possessed of these noble qualities, and just entering upon the period of his life when they began to show their real power and they could be used to the best advantage, he was called away, leaving many a friend to mourn his untimely death, and not a few subjects of study to feel the want of his acute reasoning. How these faculties were used, and the promise given for the future, will be shown in the sketch of his brief but very active life.

During his leisure moments, he wrote a brief autobiography, to which access has been given through the kindness of his mother, and it is to this that I am indebted for many of the facts concerning his life.

Walter A. Dun was born at Plumwood, Madison County, Ohio, March 1, 1857. His early education was received at home and in the public schools. In October, 1873, he went to Chillicothe, O., where he studied with his grandfather until the following January.

He entered the Ohio Agricultural and Mechanical College (now Ohio State University) at Columbus, February 14, 1874, and graduated from this institution in June, 1878, receiving the degree of Bachelor of Science. His class, consisting of six members, was the first graduated from the university.

In his college life he was a faithful successful student, and won the highest regards of his professors and associates; he was one of the organizers of Alcyone Literary Society in the college, and was a member of the Phi Gamma Delta Fraternity. During the vacations of these various years he worked in the summer on the farm at his home, and went on brief visits to the neighboring cities, especially Cincinnati.

In 1878, through the influence of Dr. Wm. Carson, he came to this city to begin the study of medicine under the preceptorship of the doctor. He attended Miami Medical College, and passed final examinations in all departments of that institution, winning the faculty prize of $100 in gold. In February, 1881, he was elected a resident of the Cincinnati Hospital, where he continued until after his graduation from the medical college.

During these years of study in Cincinnati, he suffered two severe attacks of sickness; in the summer of 1880, he had typhoid fever; and of this time he says, "I was tenderly cared for by Dr. Carson and his family at his house." The second attack was a light case of smallpox, and during his convalescence from this disease, while still confined in the hospital, he prepared for his final examinations. In March, 1882, he took the degree of M. D.

Not satisfied with the knowledge already gained, he at once made preparations for spending a year of travel and study in Europe, sailing from New York on April 5, 1882.

On his arrival in London he entered application for admission to examination to the Royal Colleges, (Physicians and Surgeons). He then entered University College Hospital, also the Physiological Laboratory, here he took a course of study in bacteria and histology, which he completed in July; he then went to Paris thence to Strasburg, and the Teutonic portion of Switzerland, returning to London by way of Basle, Heidelberg, and down the Rhine to Cologne; thence to Brussels and Antwerp, to Harwick and London. His application to the Royal Colleges being granted, he passed the required examinations, and received the degree L. R. C. P. (Licentiate of the Royal College of Physicians) in October, and M. R. C. S. (Member of the Royal College of Surgeons) in

November, 1882. After another and more extended visit to the continent and a tour through England and Scotland, he returned to New York, March 26, 1883, and after a visit to his home at Plum. wood, he returned to Cincinnati and located at 63 E. 4th St.

Soon after, he accepted the position of demonstrater of histology at the Miami Medical College, and in June took charge of Dr. Taylor's Clinic for the diseases of children, for the summer.

Doctor Dun was intimately identified with the Children's Hospital of the Protestant Episcopal Church on Mt. Auburn. He was elected to the staff of visiting physicians, in December, 1883, and continued in connection with the institution until his death.

He was an earnest worker for the welfare of the hospital, and this zeal combined with his rare ability and strong character, made him an invaluable associate of the officers and physicians, while his kind, happy disposition, combined with his fondness for children made him a favorite among them; and nowhere was this more touchingly shown, than when he passed through the wards of the hospital, and his cheerful words to the little sufferers, were received with a bright smile of welcome, and a look of tender affection. The hospital was a project for the success of which he worked with his usual zeal, and perhaps here more than anywhere else in his public life may we look for the tender, unwritten history of that sympathetic soul. At the laying of the corner-stone he said, with enthusiastic fervor, to Mrs. McGuffey: "I could give three cheers," and it is one of the saddest features of his death that, before that building was completed, he had passed away. One of the highest tributes to his memory was that paid by Dr. Wm. Carson, his preceptor and intimate friend, at the dedication of the hospital, November 23, 1887.

On April 8, 1886, Dr. Dun was appointed a member of the Board of Police Examiners, in which capacity he served with great efficiency, until attacked with his last illness. While in this position he prepared a valuable paper on the "Police Standard of Cincinnati," which was published in the "Lancet and Clinic," Vol. 18, page 131.

Of all the institutions with which the Doctor was identified, no one has felt his loss more keenly than the Cincinnati Society of Natural History.

An ardent lover of Natrue, he gave himself to its study with enthusiasm. Soon after coming to the city he became a member of the Society, and one of its warmest friends and supporters.

The results of his work in Natural History were given for the benefit of the Society, and did much toward giving the Society the eminent position which it holds to-day.

From the first he was enthusiastic for the advancement of the Society in all its interests: he sought to extend its influence in the city and increase its membership, and in both was eminently successful, aiding to place the Society on a broad basis in the public estimation, and bringing to it large and valued additions in membership.

He was elected President of the Society in 1886, and was a member of the Executive Board at the time of his death. In his address given at the time of taking the President's chair, he gave it as his purpose to devote his energies in behalf of the Society, especially toward the increase of the Building Fund, that it might soon be possible to provide the necessary accommodations for the increased requirements of the museum and educational work of the Society. In this cause he labored earnestly, and no doubt would have been successful in his endeavors had he been permitted to continue his work.

The Lyceum of Natural History for young people owes its existence largrly to his suggestions and efforts in its behalf, and it became second only to the Building Fund in his favorite projects for the advancement of the Society. The first address given to the Lyceum as an organization was given by him on the "Early History of the Earth." In his final address at the close of his term of office as President he expressed this sentiment: "While my efforts will be given for the good of every part of the Society's work, two of them shall I seek most earnestly to advance; these are, the Building Fund and the Lyceum."

Another department of the work of the Society which he sought to develop and extend was that of the Meteorological Section. He endeavored to organize a society in the Ohio Valley for the study of meteorological phenomena, to be conducted in connection with the Society, and succeeded in enlisting the sympathy of the meteorologists of this city and vicinity in his project. He furnished to the Society at his own expense a set of weather symbols, to be used in announcing weather predictions.

In the regular scientific work of the Society he contributed many valuable papers for publication in the Journal, a list of which is given below:

"A Brief Sketch of Floods in the Ohio River." Vol. 7, p. 104.

"Ancient Earthworks in the State of Ohio on the Little Miami River." Vol. 7, p. 83.

"Exploration of Deer Creek Mound." Vol. 7, p. 194.

"Swiss Lake Dwellers." Vol. 7, p. 87.

"Report and Observations on Relic Finds." Vol. 8, p. 85.

"Petrified Human Bones found in a Mound near Fort Hill." Vol. 8, p. 176.

"Observations on Periodical Cicada." Vol. 8, p. 233.

"Report on Mound Explorations in Green County, Ohio." Vol. 8, p. 231.

Besides these published papers, he has given many valuable contributions to the Society in the way of informal talks and lectures. Three of the latter were given in the Free Lecture Course on the following topics:

"The Scientific Value of Arctic Explorations."

"On the Zuni Indians and their Civilization."

"Climate, Plant Life and Consumption."

There was no department of the Society which did not feel the stimulus of his energy and perseverance; his spirit pervaded all, and its influence will long be felt though he has been removed from the midst of the work.

The discovery of natural gas opened a new field for scientific inquiry, and Dr. Dun entered upon it, giving special attention to the possibility of finding gas in the vicinity of Cincinnati, and to the solution of the problem regarding the position and character of the Utica and Trenton formations in this vicinity. The data for for this work were obtained largely from the records of well borings in Cincinnati and vicinity, and much laborious work and care were necessary in obtaining them. The writer assisted in this work, and can speak from personal knoweledge of the conscientious care exercised by the Doctor in collecting his materials.

The results of this investigation were given to the society in the address given at the close of his term of office as president, though at that time they were necessarially incomplete, and it is to be regretted that these results were not prepared in a form for publication.

Of the value of his work in this connection, Professor Orton, the State Geologist, writes: "Dr. Dun wrote two long letters to me in regard to the stratigraphy of the Cincinnati rocks as determined from the drillings that were going forward. The letters seemed to me very discriminating and valuable. I used them in my report so far as the main facts were concerned.

"I am very sure that the doctor would have made valuable contributions to geology, if he had kept his interest in the subjects pertaining thereto. His clearness and thoroughness would have insured the result. If he did anything he must do it well.

"I cannot tell you how much I deplore his loss, I feel a pang of grief at his untimely departure, whenever his name comes to my mind. I cannot reconcile myself to his taking off."

This expression finds a response in the heart of every one who knew the doctor.

Aside from his professional studies, the subject which more than any other may have been called his specialty was Anthropology. In this he did most careful and valuable work, and in recognition of his contributions to this department of knowledge, he was elected a Fellow of the American Association for the Advancement of Science in the section of Anthropology, at the annual meeting of the Association, in 1886.

Personally, the doctor possessed the most excellent characteristics. With a disposition happy and almost boy-like in its bouyancy, a warm sympathetic heart, plain spoken, and true as steel, his personal friendship was a treasure to all who gained it. Of an upright Christian character, invariable in his devotion to truth and justice, he at all times did that which he believed to be his duty without regard to the opinions or favor of men.

A man of true culture and refinement broad in his learning and opinions, he was most acceptable in all social and learned circles.

Before concluding this sketch, I wish to acknowledge with sincere gratitude the kind aid given by Mrs. Annie L. Dun in the preparation of this memorial of her son, and to assure her again of the deep sympathy felt for her by all.

The story of his life is finished; brief though it was, it was full of earnest conscientious work. The influence of that life will long be felt in all those circles of this community in which the doctor lived and worked. It was a life well worthy of imitation by every youth in its fulness, sincerity and true nobility of character.

All that was mortal of Walter Dun was laid to rest in the cemetery at Dayton, Ohio. His works and influence will be enduring; and while feeling the keenest sorrow for his loss, it should not be a sorrow which folds the hands in inaction, but which awakens the spirit of those left behind to more earnest zeal, that the noble projects started by him may not fall, but be established as enduring monuments to his memory.

As one who enjoyed the personal friendship of Doctor Walter Dun, and who has on many occasions felt the sincerity and value of that friendship, I humbly ask to make this small tribute to his memory, treasuring in my heart as many another will, precious recollections of that true friend.

EXPLANATION OF PLATE I.

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2*a*.	The same: surface enlarged	
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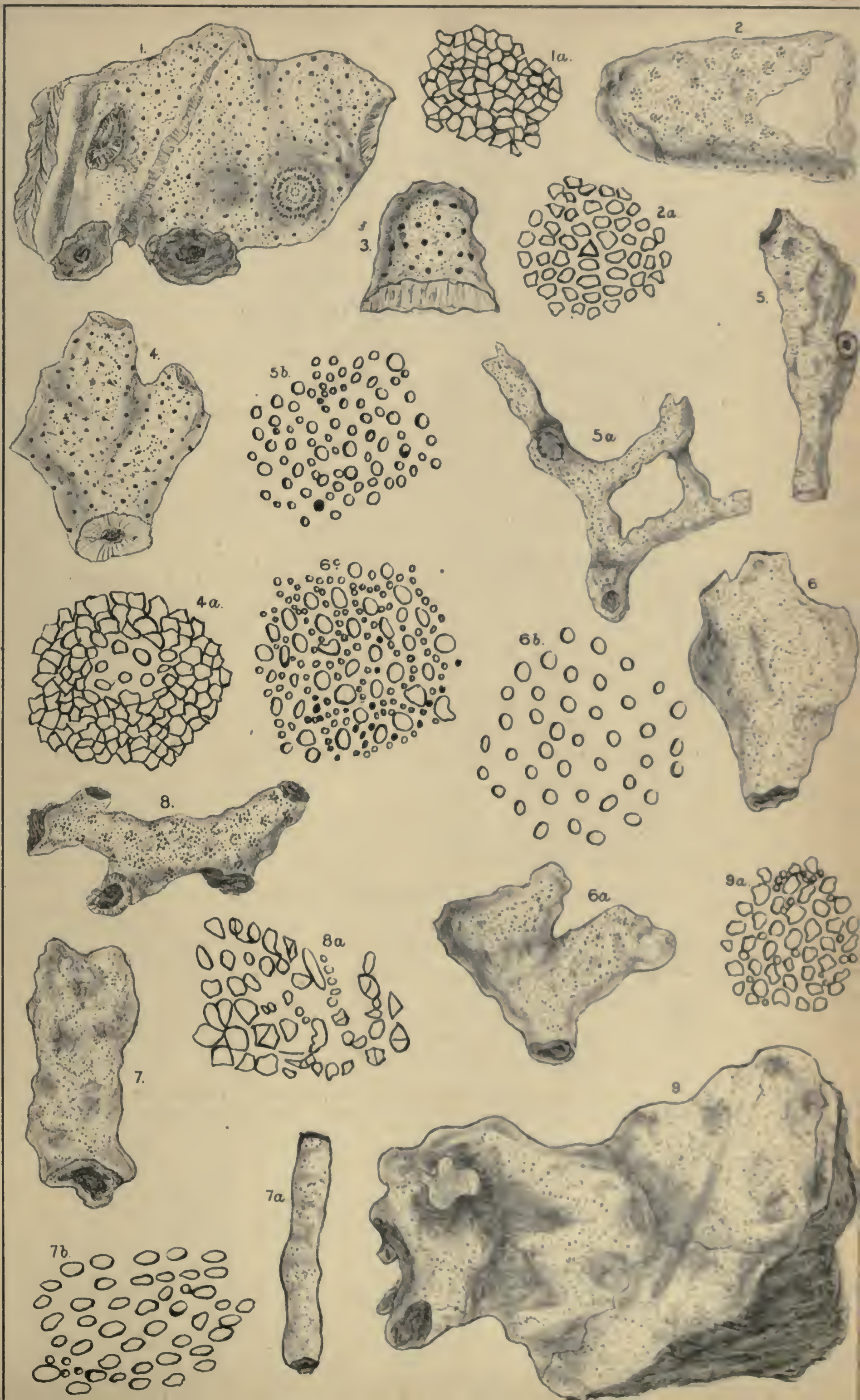
NOTE The enlargement of the surface of the specimens as noted above, was tha furnished by A Eyepiece and a 2-inch objective. The drawings were made with a camera lucida.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THE JOURNAL

OF THE

Cincinnati Society of Natural History

Vol. XI. Cincinnati, July-October, 1888. Nos. 2 and 3.

PROCEEDINGS.

ANNUAL MEETING, *April* 3, 1888.

President Skinner in the chair. Twenty-seven members present.

The minutes of January business meeting were read and approved.

The following names were proposed for active membership: Miss Lucy LeBoutillier, Charles Andrews, Dr. George M. Allen, Dr. Joseph Anderson, Richard Ellison, Kyle Holloway, Fred. Tishbein, Mrs. L. C. Weir, W. A. McCord, John M. Stacy, H. N. Kitchell, Jerome B. Clark, William F. Gray, Collin Ford, Mrs. Jennie A. Netter.

The following persons were elected to active membership: Miss Lucia Stickney, Aaron A. Ferris, Miss Eugenia Iliff, A. L. Reum, Nathaniel L. Davis.

Minutes of Executive Board for January, February and March read and approved.

Report of Centennial Exposition Committee read and approved.

Report of the Treasurer, S. E. Wright, was read and referred to Auditing Committee.

President Skinner read the report of the Executive Board on "Condition of the Museum and Library."*

The following officers of the Society were then elected for the ensuing year:

President, J. Ralston Skinner.
First Vice-President, William Hubbell Fisher.
Second Vice-President, Davis L. James.
Secretary, Dr. James A. Henshall.
Treasurer, S. E. Wright.
Librarian, Miss Amanda Frank.

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*Printed in Journal of the Society, for April, 1888.

Curators:

Geology, C. L. Faber.
Entomology, George B. Twitchell.
Botany, Prof. Joseph F. James.
Zoölogy, Charles Dury.
Osteology, Dr. O. D. Norton.
Anthropology, Dr. Gustav Bruehl.
Photographic Section, George Bullock.
Meteorology, H. P. Smith.
Microscopy, Dr. B. Merrill Ricketts.
Physics and Chemistry, Dr. W. S. Christopher.

The following were elected members at large of the Executive Board:

Prof. George W. Harper. A. D. Smith.
Dr. O. D. Norton. Rev. Raphael Benjamin.

The election of a Trustee was postponed until next meeting.

The following Committee was appointed to audit the report of Treasurer:

Davis L. James. Wm. Hubbell Fisher.
William H. Knight.

Upon motion duly carried, the stereopticon of the Society was loaned to the Unity Club to illustrate a lecture.

Mr. R. H. Warder stated that there was a strong probability of the library of the late Horticultural Society being presented to the Society, if permission was granted to have it deposited, for the present, in the library of the Society.

The proposed amendments to the Constitution, Article VI., Section 3, and By-Laws, Article II. Section 4, were read (See Journal, April 1888, pages 12, 13).

Donations were received as follows: From G. H. Curtis, Diatom Slide; from Mrs. James D. Lehmer, miscellaneous Specimens and Curios; from William Graham, specimen of *Ammonites mulgravius*.

Adjourned.

Scientific Meeting, *May* 1, 1888.

President Skinner in the chair. Ten members present.

The President called the attention of the members to the improved condition and appearance of the Society's rooms, and to the admirable manner in which the repairs and renovation of the same had been carried out.

The minutes of the March scientific meeting were read and approved.

Mr. M. D. Burke read a paper entitled "Drift: its distribution and character in the vicinity of Cincinnati, when considered as a probable source of water supply."

The following names were proposed for active membership: Larz Anderson, Jr., Mrs. J. Ralston Skinner, Miss Wiggins, William McMasters, David W. Blymyer, Mrs. Mary L. Fisher, Miss Eliza A. Fisher, Samuel J. Broadwell.

The following persons were elected to active membership: Jerome B. Clark, Kyle Holloway, William F. Gray, H. N. Kitchell, Fred. Tishbein, W. A. McCord, Collin Ford, Charles Andrews, Dr. Joseph Anderson, Dr. George M. Allen, Richard Ellison, John M. Stacy, Mrs. L. C. Weir, Mrs. Jennie W. Netter, Miss Lucy LeBoutillier.

Mr. Aaron A. Ferris was elected Trustee for two years.

The amendments to Constitution, Article VI., Section 3, and By-Laws, Article II., Section 4, were then read, and upon motion carried unanimously.

Prof. G. W. Harper and William Hubbell Fisher were appointed a Committee to examine and report on the provisions of the Constitution and By-Laws in relation to "Sections" of the Society, as to their definiteness, and what amendments, if any, were necessary.

The Auditing Committee reported that the accounts of the Treasurer, for the past year, were in good form and correct.

The list of donations was then announced by the Custodian as follows: From Mrs. James D. Lehmer, specimens of salt crystal, chalcedony, shells, etc.; from Lewis Swift, Rochester, "History and Work of Warner Observatory;" from H. D. Williams, city, specimen of *Dynastes tityus* and larvæ of Royal Moth; from T. H. Aldrich, the "Aldrich Collection" of Corals, Sponges, etc., from Bermuda.

Adjourned.

SCIENTIFIC MEETING, *June* 5, 1888.

First Vice-President Fisher in the chair. Eight members present. No Quorum.

The minutes of the May scientific Meeting were read.

Dr. O. D. Norton exhibited a leaf and flower of the Peacock plant (*Strelitzia regina*); remarks were made upon the same by Dr. Norton and Davis L. James.

President Fisher exhibited an alcoholic specimen of a fish, *Morone interrupta* (Yellow Bass), as large as a man's hand, that he took from the stomach of a double-crested Cormorant (*Phalacrocorax dilophus*), sent him from Carlisle, Illinois. The fish was in a good state of preservation, except the head, which was partially digested.

Mr. H. P. Smith exhibited a fine specimen of a Stag-beetle (*Lucanus elephas*).

Dr. O. D. Norton exhibited a collection of fossils, minerals, archæological relics, etc., donated by Mrs. C. S. Muscroft, Jr.

Mr. Warren K. Moorehead exhibited a fine specimen of *Lepidodrendron*, showing the bark, fruit, etc., and made some very interesting remarks on the same. He also stated that some skulls recently taken from the stone graves at Fort Ancient, Ohio, showed a remarkably acute facial angle.

A quorum now being present, the minutes of the last meeting were approved.

Mr. William P. Anderson was proposed for active membership.

The following were elected to active membership: Samuel J. Broadwell, Larz Anderson, Jr., David W. Blymyer, William McMasters, Mrs. J. Ralston Skinner, Miss Wiggins, Mrs. Mary L. Fisher, Miss Eliza A. Fisher.

The list of donations was then announced by the Custodian as follows: From W. W. Seely, M. D., city, American Bittern (mounted); from William T. Orange, city, Whippoorwill; from S. T. Carley, Bantam, Ohio, slab of Murchisonia, collection of Fucoids; from Miss Clarissa Gest, city, Nubian Girdle; from Felix, Baron von Thümen, Gorz, Austria, author, pamphlet, "*Die Pilze Obstgewachse*;" from Edward P. Morris, city, specimen of wood from the "Penn Elm;" from Amos W. Butler, Brookville, Ind., author, miscellaneous pamphlets; from U. P. James, city, author, Monograph of the Monticuliporoid Corals, of the Cincinnati Group; from Prof. J. W. Spencer, author, Columbia, Mo., miscellaneous pamphlets; from H. D. Williams, city, specimen of *Lucanus elephas;* from Prof. Joseph F. James, Oxford, "Catalogue of Miami University;" from Mrs. Dr. Muscroft, through Dr. O. D. Norton, the Muscroft Collection of minerals, shells, etc.; from Winthrop McGuffey, city, *Limulus polyphemus;* from Hon. Henry Mack, city, fifty-two volumes of Volume VI., "Geological Survey of Ohio."

Adjourned.

BUSINESS MEETING, *July* 3, 1888.

First Vice-President Fisher in the chair.

Minutes of Annual Meeting of April read and approved.

The minutes of the Executive Board for meetings of April, May and June were read.

The amendment to Article VI. Section 3, of the Constitution, was presented for a final vote and carried.

Mr. William P. Anderson was elected to active membership.

Dr. J. A. Henshall read a paper on "Some Peculiarities of the Ova of Fishes;" referred to Committee on Publication.

Dr. O. D. Norton exhibited some specimens of plants from Watch Hill, R. I., and made some interesting remarks thereon.

Dr. Henshall read by title a paper, "Contributions to the Ichthyology of Ohio." No. 1. Referred to the Committee on Publication.

Prof. W. R. Lazenby, of Ohio State University, gave some interesting suggestions on the work of Natural History Societies.

Donations were received as follows: From S. D. Spence, Ludlow Grove, specimen of Fungus; from Pelham Ellis, city, minerals; from J. M. Phillips, New Haven, Pa., Least Bittern (mounted); from A. E. Heighway, M. D., large collection of Fossils from Phosphate Beds, Buford County, S. C.

Adjourned.

SCIENTIFIC MEETING, *August* 7, 1888.

Vice-President Fisher in the chair.

Minutes of the June scientific Meeting were read and approved, subject to the action of a quorum, there being no quorum present when read.

Mr. M. Neumann, of California, gave a very interesting lecture upon "Silk Worm Culture," which was followed by a general discussion of the subject.

A vote of thanks was extended to Mr. Neumann.

A quorum was now present.

Mr. Davis L. James exhibited a very fine specimen of marine algæ, *Laminaria saccharina*.

Donations were received as follows: From J. A. Cassell, city, Stalactites from Mammoth Cave; from United States National Museum, through G. Brown Goode, five boxes Foraminifera; from Hon. Charles Bird, city, fifteen volumes "Ohio Geological Survey," Vol. VI. with maps; from Department of Interior, through Hon. C. E. Brown, complete set of "Reports of United States

Geological Survey;" from J. L. Foley, Covington, specimen of *Corydalus cornutus;* from Col. J. W. Abert, Newport, specimens *Unios;* from Prof. Joseph F. James, Oxford, miscellaneous pamphlets.

Adjourned.

SCIENTIFIC MEETING, *September* 4, 1888.

Vice-President James in the chair.

Mr. Harry W. Brown, Secretary *pro tem.*

Minutes of August scientific Meeting read and approved.

Prof. David Boyd, of Ontario, read a paper on "Biology as a Factor in National Education."

Remarks on the subject were made by Dr. Norton.

Prof. Joseph F. James read a paper on "The Ancient Channel of the Ohio River at Cincinnati."

On motion of Mr. Charles Dury a vote of thanks was extended the gentlemen for their very instructive papers.

Dr. B. M. Ricketts made remarks on observations made during the excavation for the piers of the Huntington Bridge, which were followed by a general discussion.

Prof. Joseph F. James read a paper on "The Ivorydale Well," illustrated by a diagram.

Sergeant P. T. Jenkins was proposed for active membership.

The resignation of Prof. Joseph F. James as Curator of Botany read and accepted.

The Chair gave notice of an election of Curator of Botany to take place at the next regular meeting of the Society.

Resignations of Mr. and Mrs. W. D. Holmes read and accepted.

Donations received as follows: From Warren-Scharff Paving Co., specimen of Trinidad Asphalt; from Dr. O. D. Norton, specimen of *Laminaria saccharina*; from Chief Signal Officer, Washington, D. C., "Reports for 1885," Parts 1, 2; "Reports for 1886, 1887," Part 1; from J. K. Martin, Melbourne, Fla., specimen of *Romalea microptera.*

Adjourned.

DRIFT.

Its Distribution and Character in the Vicinity of Cincinnati, When Considered as a Probable Source of Water Supply.

By M. D. Burke, C.E.

(Read May 1, 1888.)

Recent allusions in the public press to cities now obtaining their supplies of water by the system known as "gang wells," or "driven wells"—notably at Sioux City, Iowa, and Brooklyn, New York—has led the writer to consider the probability of looking to such a source for at least an auxiliary supply for the city of Cincinnati.

Were an engineer employed to prepare plans for supplying the city of Lawrenceburgh with water, he would hardly be likely to go directly to the present channel of either the Ohio or the Great Miami river with his pumping works and draw therefrom the turbid waters and attempt their purification in expensive settling basins; but he would penetrate the gravel bed, underlying the city to the level of the river channel, and draw therefrom water filtered ready for delivery for any use that might be required. In this case it is known that the plain, or bottom, upon which the city of Lawrenceburgh stands, is underlaid by a thick stratum of gravel carrying an inexhaustible supply of clear water, sufficiently pure for domestic uses. Inasmuch as this condition is known to exist in our immediate neighborhood, the question at once arises, Can not like conditions be found where the water can be used for supplying the city of Cincinnati?

In searching for an answer to this query, we naturally look to our geological and topographical surroundings. The rocks of our "Cincinnati group" we find to be Lower Silurian, the strata but very slightly inclined from the horizontal—evidence at once of two conditions: First, that the land upon which we now reside has been exposed to the action of subaerial agents ever since it first emerged from the Silurian seas; and second, that it has never been greatly elevated or effected by volcanic or seismic action. In other words, this portion of the country, in which the Lower

Silurian appears as the surface rocks, existed as an island, from the surface of which the winds and storms of countless centuries grooved out and carried away, to the surrounding seas, material for the formation of the Devonian and Carboniferous rocks; that, with the growth of successive geological formations, our elevation and area increased, finally becoming continental.

During the successive geological periods in which were deposited all the sedimentary rocks, from the Silurian to the Cretaceous, the topographical features appear to have been formed in what might be termed a "normal condition." Evidently, the uplands were comparatively level plateaus, upon which were the sources of watercourses that united to form rivers, with their channels and flood-plains. The ancient streams that carried to the sea the sediment which formed the Carboniferous rocks, and the immense timber rafts which form our coal deposits, were undoubtedly the engravers that marked out the lines which are now followed by many watercourses of the present day. These ancient valleys of erosion were deeper than the present river channels. It is fair to presume that they were bounded by banks and bluffs more precipitous than those of the present day, for we find that the existing topographical features have been modified by an agency operating in a peculiar manner, subsequent to the deposition of the highest rocks of the Tertiary formation. This was the "Ice Age," or "Glacial Epoch," when our hills and valleys received their coating of boulder clay, or drift. That the modifications were radical, and that the graving tools of the Ice King were wonderfully effective, is evident from the most cursory examination. Water-courses were in many places changed, and the ancient channels were silted up to a depth of about forty feet, when the stream remained in the same valley, so that the gravel bars of the ancient rivers are found at and below the present low water level, and the ancient flood-plain or bottom lands adjoining the streams are now found but six to ten feet above our extreme low water level.

Evidences of this condition of facts are so numerous as to scarcely need citation It is illustrated by a section on page 427 of Volume I., "Geological Survey of Ohio," and confirmed by nearly all the borings and excavations that have been made through the drift deposits of the valleys. The essential fact to be noted in this connection is that the gravel and boulders of the ancient river channels consist largely of sandstone and granitic pebbles, while the gravel beds of the more modern and upper terraces are composed in very great part of limestone. The lower gravel beds, therefore, carry the undercurrent of the Ohio, or the waters of the ancient stream, while the modern drift and upper terraces carry the waters of our limestone hills. When the ancient drift is penetrated, where it is not too remote from the Ohio River, we obtain filtered Ohio River water.

The general topographical features of the immediate vicinity of Cincinnati are quite familiar; yet there are very few who have studied in detail the forms and positions of the surrounding hills and valleys. The general direction of the Ohio River is south of west, its channel being about four hundred feet below the level of the plateau on either side. From the North it is joined above the city by the Little Miami, and about twenty miles below the city by the Great Miami, the direction of each being west of south, each passing through a well-defined valley corresponding in depth to that of the principal water-course. Directly opposite the city the Ohio is joined by the Licking River, flowing in a northwesterly direction. These facts are generally known; but the valleys of the minor tributaries, their forms, directions and connections, as well as the windings of the greater and lesser valleys, with their coves and terraces, are known only to the special topographical student. For example, Mill Creek, joining the Ohio from the North at Cincinnati, is a minor tributary, yet its valley is of such a nature as to furnish a satisfactory reason for building a great city where Cincinnati now stands rather than at any other point on the north bank of the Ohio within the limits of the State.

Any attempt to estimate the number of years which the limestone plateau, which we term the "Cincinnati group," has been exposed to the eroding action of the subaerial agents would be puerile. Could the time be determined, and the number of years written in figures, it is entirely probable that the magnitude expressed would be altogether incomprehensible to our minds. The accompanying diagrams show, in geological epochs or periods, the comparative age of the rocks in this locality and how near they lie to the base of the Geological Column, as known to us.*

An examination of these sections at once reveals the fact that this formation is of great age; and—when we reflect on the gradual manner in which sedimentary rocks are formed; that the "Cincinnati Anticlinal" is flanked by formations aggregating miles in thickness; that after the Carboniferous Era occurred the great Appalachian uplift (the fault along that line seldom being estimated at less than twenty thousand feet, of which at least three miles in depth has weathered away), we must inevitably conclude that the Silurian Seas, in which these rocks were deposited, existed at a time so remote that the years that have passed would be expressed by a number to us utterly incomprehensible—we rather agree with Hutton that "There are no traces of a beginning, no prospect of an end."

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* See Sections of Rocks, "Dana's Manual of Geology," page 131; and Volume I. of "Geological Survey of Ohio," page 88.

After this limestone plateau had withstood the weathering action of the countless ages required for the formation of the Devonian rocks, and had contributed of its substance for that purpose; after it had sent its timber rafts both East and West to aid in forming the great coal deposits of America (and after the coal had been covered by the Lias, the Oolitic, the Cretaceous and the Tertiary formations), came that peculiar period commonly known as "the Glacial Epoch," when this area received its first addition from the surrounding country since the time it first emerged from the Silurian Seas. The hills and vales that we now see came forth in substantially their present form from the fearful ordeal of that indefinable and debatable epoch.

Although among the most recent of geological formations, and exposed to the direct examination of all who care to study its peculiarities, and although it is of the greatest utility to man, yet the study of "The Drift" has given rise to greater diversity of opinions among geological students than any or all other formations combined. From the weird, fascinating theory of Ignatius Donnelly, who advances the idea that our planet collided with a comet and was covered with dust from its tail, to the skeptical assertion of a Miller, who claims that no such epoch ever occurred, we have surmises and theories sufficient to cover all intermediate ground.

Whatever may have been the condition or climate of this planet during this epoch, or whether or not there occurred an interglacial epoch of ten thousand five hundred years as evidenced by the precession of the equinoxes, yet this we know: the sedimentary rocks of the northern portion of the United States are quite generally covered with a clay containing angular fragments and boulders of erratic rocks. We call this substance the Boulder Clay, or "Drift." We find plateaus or plains grooved by valleys of erosion that are in no way proportioned to the streams that now occupy them. We further find these valleys flanked by, or containing, terraces or banks of sand and gravel, evidently of riparian origin, and that these deposits were made when water was very abundant. We know the boulder clay and valley drift as the great water-bearing material of the country. But we find little of the clay drift, except in the form of river silt below the level of the gravel terraces.

Sections of the alluvial deposits in the valleys of this vicinity show two features worthy of careful study, as they appear with persistent uniformity in all the deeper valleys upon one or both sides of the stream. First, bed-rock lies from thirty to fifty feet lower than the present channel of the water-course, showing that the valleys have silted up to that extent. Second, a well-defined soil, with driftwood and frequently standing stumps of trees, at near the level—generally five to ten feet above—of low water of the principal water-course. This ancient soil is again underlaid by the sand bars and gravel beaches of the water-course as it existed before the silting up of the valley.

Let us now turn to figure 3, a sketch map of the vicinity of Cincinnati, and imagine what might have occurred during the Glacial Epoch. We will imagine a water-course occupying the valley, but not necessarily in all cases the present channel of the Ohio River, with its bed at the level at which we now find bed-rock, and its flood-plain, or river bottoms, at the level of the ancient soil. We will suppose it to be joined by a tributary at or near where the Little Miami now joins it; this tributary recieves a branch rising on the plateau near the present position of Norwood; the high land then extending in an unbroken line from the river bluff (Walnut Hills) to Pleasant Ridge and beyond, but deeply gashed by this precipitous stream on the east, and a like branch on the west, falling near Chester Park into the river that, flowing nearly south through the valley now occupied by Mill Creek, joined the main water-course at this point. The great ice field approaches from the North, and, by its increasing thickness, attains an angle that, when the brief summers come and the surging waters of the southern tributaries of the Ohio are poured into the valley and melt their way through the channel, cutting away the toe of the ice field, causes it to move steadily down, and adds to the floods that are hurrying to the sea. The glacier moves steadily on, pushing the current against the Kentucky hills, which will not yield. The river is obstructed, the waters rise higher, the channel from Price Hill to the adjacent Kentucky cliffs is sealed, the seathing floods are poured into the great basin at the mouth of the Little Miami and find their way across the narrow neck of highland that connects Walnut Hills with the plateau beyond. As the ice is weakened there by the breaking down into the valleys on either side, the narrow neck of highland is soon scooped out by the seathing flood, the clay silts up the river valleys, and the rocks, broken and rounded by wearing on each other, form the gravel banks of our highest terraces. But the Ice King will not yield, though his ranks may be broken; and, reinforced by the arctic winters of that period, he extends his conquests from the pole to Alabama and marks the limits of his holdings by the floods that groove out the channel of the Tennessee. He is driven back, and the Cumberland marks his outposts; again he recedes, and the Kentucky marks his intrenched line. In the meantime the latent heat of the earth has been sapping the very foundations of the magnificent structure he has reared, and every valley is pouring from his vitals floods to the seas. His mountains of ice are toppling over the hills and grinding them into the valleys, and not only is his advance driven back, but there is discord and commotion in the very heart of his camp. He falls back from the line of the Kentucky. He piles mountains of ice and drift in the Ohio, sealing it from cliff to cliff, and in like manner closes the little Miami. But the waters creep from under his icy, drift-ladened towers. The seething floods of the Ohio go roaring against the ice dam in the Little Miami, break across the broad, new channel at Norwood; are joined by the Licking, that is sweeping against what was the current of the Great Miami, scooping away the hills and filling the ancient gorge to make room for the building of our goodly city, and, surging against the flank of the foe, pass around the highland by the Hamilton route and are joined by such hordes of reinforcements—that escape from under the main glacier—that the torrent is miles in width, and it carries away whole townships of our limestone plateau, turning the rocks into immense gravel beaches, fairly filling the sea with the mud which it carries down; but it is overloaded, and against the immense ice dam at North Bend it heaps great banks of slimy silt. There is victory in the genial sunbeams, glinting across the lifeless glaciers; and even the Little Miami defies the Ice King. It finds an outlet up the Turtle Creek tributary, cuts away the highland to Middletown, and soon holds this as the base of the glacier. Life, which for ages has been driven away, or held in bondage by the

Ice King, is returning. One by one the outposts of the arctic tyrant are falling. The ancient channel of the Ohio is unlocked, but when the enemy retires, it is found ineffectually barricaded at North Bend by a monument of mud, whice holds the Great Miami away on a devious course for ten miles, and, after untold centuries have worn it away with their storms and floods, is still more than five miles long by two hundred feet high. Even in death, the Ice King is terrible. What can not be frozen may be drowned. As his icy fingers released their grasp, and the "rivers flow unvexed to the sea," their channels are filled with "modified drift," and high-water-mark is from hill to hill. The proud Miami is forever turned—its ancient channel only serving as a vent for the "spring freshets," which are soon lowered, so that the sole tenants of the magnificent valley are, for surface drainage, our insignificant Mill Creek, and, under it, upon the original rock bottom, passing through the "modified drift," the trickling underground current of the ancient stream. *There* is clear, cold water, free from surface contamination, when found beneath the ancient flood-plain; but it may not suit our fastidious tastes, as it will bring magnesia from the Dayton stone and lime from many hills.

But where can we find the pure water of the ancient Ohio, filtered through the sandy pebbles that lined its shores, before the reign of the Ice King? Evidently, wherever such gravel bars are found beneath the original flood plain. We know this stream flows beneath the village of Dayton, Kentucky, because, in rather an unsatisfactory manner, it has been found there. Can it be found in the great cove above the city? Every probability says it is there. Not, however, adjacent to the foot-hills, nor in the Miami terraces, nor even in the ancient channel, which was hard against the Ohio cliffs, and is now filled with muddy silt; but far out in the bottoms, where the southern shore of the ancient water-course piled the sandy pebbles from the Kanawha, as it collided with the current of the Little Miami and swung past the beetling cliffs of the Ohio shore, now crowned with the residences that beautify East Walnut Hills.

CONTRIBUTIONS TO THE ICHTHYOLOGY OF OHIO.

No. 1.

By Dr. James A. Henshall.

Read at the Society's Scientific Meeting, July 3, 1888.

The present paper is the first of a series intended to place on record the fishes of Hamilton County, Ohio, and eventually those of the entire State, so far as possible.

During the latter part of April, and in the month of May, 1888, Prof. Charles H. Gilbert and the writer, assisted on several occasions by Mr. Clough Anderson, explored the Little Miami River and its tributaries at several points between Loveland and its mouth; Mill Creek and tributaries between Lockland and Elmwood; and Ross Lake.

The writer also examined the catches of market fishermen along the Ohio River, between the mouth of the Little Miami River and Fulton, and at the latter place had a fyke-net set regularly by Mr. C. M. Weeks.

This paper records the results of these explorations. Most of the specimens were taken with a short, fine-meshed Baird seine, and a complete series of them, with the exception of those of very large size, is now in the Museum of the Society, and duplicate sets have been retained for the Cincinnati University and the United States National Museum.

All of the species named in this catalogue have been examined and identified either by Prof. Gilbert or myself.

Where there have been recent changes in the nomenclature of species I have added the best-known synonyms.

As will be seen, this paper records seventy species, distributed among fourteen families.

Family I.—Polyodontidæ.

1. Polyodon spathula Walbaum. Spoon-bill Cat. (*Polyodon folium* Kirtland.) Common in the Ohio River.

Family II.—Acipenseridæ.

2. Acipenser rubicundus LeSueur. Sturgeon. Abundant in Ohio River.

3. Scaphirhynchops platyrhynchus Rafinesque. Shovel-nose Sturgeon. Common in the Ohio.

Family III.—Siluridæ.

4. Noturus flavus Rafinesque. Yellow Stone Cat. Abundant in Little Miami River, Mill Creek and nearly all streams.

5. Amiurus melas Rafinesque. Bull-head. Very common in Ohio and Little Miami Rivers and Mill Creek.

6. Amiurus nigricans LeSueur. Ohio River Catfish. Common in Ohio River. Grows to a very large size. I saw one weighing sixty pounds.

7. Ictalurus punctatus Rafinesque. Channel Cat. Abundant in Ohio and Little Miami Rivers.

8. Ictalurus furcatus Cuvier and Valenciennes. Forked-tailed Cat. Common in Ohio River.

Family IV.—Catostomidæ.

9. Ictiobus cyprinella Cuvier and Valenciennes. Red-mouthed Buffalo. Very common in Ohio River.

10. Ictiobus bubalus Rafinesque. Small-mouthed Buffalo. Abundant in Ohio River.

11. Ictiobus carpio Rafinesque. Ohio River Carp. Very abundant in Ohio River.

12. Ictiobus velifer Rafinesque. Quill-back. Quite common in Ohio River; young ones common in Little Miami River and tributaries.

13. Ictiobus difformis Cope. Hump-backed Carp. Abundant in Ohio River; young common in Little Miami River.

14. Cycleptus elongatus LeSueur. Black-horse Sucker. Not uncommon in Ohio River.

15. Catostomus teres Mitchill. Common White Sucker. Everywhere abundant.

16. Hypentelium nigricans LeSueur. Stone Roller. Common in all swift streams.

17. Erimyzon sucetta oblongus Mitchill. Chub Sucker. Common in Little Miami and Ohio Rivers.

18. Minytrema melanops Rafinesque. Spotted Sucker. Not uncommon in Little Miami River and tributaries.

19. Moxostoma macrolepidotum LeSueur. Red Horse. Abundant in all streams explored.

20. Moxostoma crassilabre Cope. Mullet. Common in Ohio River.

21. MOXOSTOMA ANISURUM Rafinesque. Long-tailed Red Horse. Not uncommon in Ohio River.

22. PLACOPHARYNX CARINATUS Cope. Big-jawed Sucker. Not rare in Ohio River.

Family V.—CYPRINIDÆ.

23. CAMPOSTOMA ANOMALUM Rafinesque. Steel-back Minnow. Abundant in every stream explored.

24. PIMEPHALES PROMELAS Rafinesque. Black-head Minnow. Very abundant everywhere.

25. PIMEPHALES NOTATUS Rafinesque. Blunt-nosed Minnow. The most abundant minnow in streams explored.

26. CLIOLA VIGILAX Baird and Girard. Bull-head Minnow. Common in O'Bannon Creek.

27. NOTROPIS DELICIOSUS Girard. Delicate minnow. (*Hudsonius stramineus* Cope.) Abundant in Little Miami River and Clough Creek.

28. NOTROPIS WHIPPLEI Girard. Silver-fin Minnow. (*Hudsonius analostanus* Girard.) Common in all streams explored.

29. NOTROPIS MEGALOPS Rafinesque. Common Shiner. (*Luxilus cornutus* Mitchill.) Abundant everywhere.

30. NOTROPIS JEJUNUS Forbes. Shiner. Common in Little Miami River and Bloody Run.

31. NOTROPIS ARDENS Cope. Red-fin Minnow. (*Lythrurus diplœmius* Rafinesque.) Abundant in all streams examined.

32. NOTROPIS ATHERINOIDES Rafinesque. Rosy Minnow. (*Minnilus dinemus* Rafinesque.) Common in Clough Creek.

33. NOTROPIS RUBRIFRONS Cope. Rosy-faced Minnow. Quite common in east fork of Mill Creek.

34. NOTROPIS ARGE Cope. Common in east fork of Mill Creek.

35. ERICYMBA BUCCATA Cope. Silver-jawed Minnow. Abundant in Little Miami River and tributaries.

36. RHINICHTHYS ATRONASUS Mitchill. Black-nosed Dace. Common in all the streams.

37. HYBOPSIS KENTUCKIENSIS Rafinesque. Horned Dace. (*Ceratichthys biguttatus* Kirtland.) Common in Little Miami River.

38. HYBOPSIS STORERIANUS Kirtland. Horny-head Chub. (*Ceratichthys lucens* Jordan.) Common in Little Miami River and Clough Creek.

39. HYBOPSIS AMBLOPS Rafinesque. Big-eyed Chub. Common in Little Miami River.

40. HYBOPSIS DISSIMILIS Kirtland. Spotted Chub. Rather common in Little Miami River and O'Bannon Creek.

41. SEMOTILUS ATROMACULATUS Mitchill. Common Chub. (*Semotilus corporalis* Mitchill.) Abundant in all streams.

42. NOTEMIGONUS CHRYSOLEUCUS Mitchill. Golden Shiner. Common in Bloody Run and Clear Creek.

43. CARASSIUS AURATUS Linnæus. Goldfish. Not rare in the canal basin near Elmwood; escaped from private ponds.

Family VI.—HYODONTIDÆ.

44. HYODON ALOSOIDES Rafinesque. Black-toothed Herring. One specimen taken by a fisherman's net in the Ohio River.

45. HYODON TERGISUS LeSueur. Toothed Herring. Common in Ohio River.

Family VII.—CLUPEIDÆ.

46. CLUPEA CHRYSOCHLORIS Rafinesque. Skip-jack. Abundant in Ohio River.

Family VIII.—DOROSOMIDÆ.

47. DOROSOMA CEPEDIANUM LeSueur. Hickory Shad. Very common in Ohio River.

Family IX.—PERCOPSIDÆ.

48. PERCOPSIS GUTTATUS Agassiz. Trout Perch. Abundant in Little Miami River below the dam at Loveland.

Family X.—CYPRINODONTIDÆ.

49. ZYGONECTES NOTATUS Rafinesque. Top Minnow. Very abundant in Ross Lake.

Family XI.—ATHERINIDÆ.

50. LABIDESTHES SICCULUS Cope. Silversides. One specimen from Bloody Run. Common in Ross Lake.

Family XII.—CENTRARCHIDÆ.

51. POMOXIS SPAROIDES Lacepède. Calico Bass. Common in Ross Lake, near Elmwood.

52. LEPOMIS CYANELLUS Rafinesque. Green Sunfish. Abundant in Ross Lake and Little Miami River.

53 LEPOMIS MEGALOTIS Rafinesque. Long-eared Sunfish. Abundant in Ross Lake.

54. LEPOMIS HUMILIS Girard. Spotted Sunfish. Common in Ross Lake and Clough Creek.

55. Lepomis pallidus Mitchill. Blue Sunfish. Abundant in Little Miami River and Ross Lake.

56. Micropterus salmoides Lacépède. Large-mouthed Black Bass. Common in Ross Lake.

57. Micropterus dolomieu Lacépède. Small-mouthed Black Bass. Common in Little Miami River.

Family XIII.—Percidæ.

58. Etheostoma pellucidum Baird. Sand Darter. Common in Little Miami River.

59. Etheostoma nigrum Rafinesque. Johnny Darter. Common in Little Miami River.

60. Etheostoma blennioides Rafinesque. Green Darter Abundant in East Mill Creek and Little Miami River.

61. Etheostoma caprodes Rafinesque. Log Perch. Common in Little Miami River and Ross Lake.

62. Etheostoma phoxocephalum Nelson. Long-headed Darter. Common in Little Miami River.

63. Etheostoma aspro Cope and Jordan. Black-sided Darter. Common in East Mill Creek.

64. Etheostoma variatum Kirtland. Blind Simon. (*Etheostoma variatum*, Kirtland, Zoöl. Ohio, 1838, 168, 192, and Bost. Jour. Nat. Hist. III., 1840, 274 (= *Nanostoma tessellatum*, Jordan. Not *Alvordius variatum* Jordan = *E. peltatus* Stauffer). Not rare in Little Miami River near Red Bank.

65. Etheostoma zonale Cope. Zoned Darter. Common in East Mill Creek and Little Miami River.

66. Etheostoma flabellare Rafinesque. Fan-tailed Darter. Common in East Mill Creek.

67. Etheostoma cœruleum Storer Rainbow Darter. Very common in East Mill Creek.

68. Stizostedion vitreum Mitchill. Ohio Salmon. Pike Perch. Abundant in Ohio River, and especially so during the long drouth of the autumn of 1887.

69. Stizostedion canadense Smith. Jack Salmon. Sauger. Common in Ohio River.

Family XIV.—Scienidæ.

70. Aplodinotus grunniens Rafinesque. White Perch; Sheepshead. Abundant in Ohio River.

ON SOME PECULIARITIES OF THE OVA OF FISHES.

By Dr. James A. Henshall.

Read at the Society's Scientific Meeting, July 3, 1888.

Fishes constitute the oldest as well as the most numerous forms of vertebrate life, which might naturally be inferred when we consider that nearly three-fourths of the surface of the globe is covered with water, and that all of this "world of waters," from the vast depths of the boundless sea to the tumbling rill of the mountain side, is teeming with fish-life, from the huge vampire or devil-fish, measuring twenty feet across its wing-like pectorals, to the little naked, nest-building stickle-back; or from the cruel, rapacious scourge of the ocean, the man-eating shark, to the diminutive, transparent darter of the spring brook, barely an inch in length.

We might also infer from this great difference in the size, form and habits of fishes the fact that there is more diversity in the eggs of fishes than in any of the oviparous vertebrates.

While most all of the sharks and rays are viviparous, all of the true fishes, with a very few exceptions (which bring forth their young alive), are oviparous; and it is my intention to merely allude to some of the peculiarities of the ova of a few of the multitude of piscine species inhabiting the waters of the earth.

Among birds, from the ostrich of the old world to the humming-bird of the new, we find a close similarity in the form and construction of their eggs. Likewise, in regard to the ova of reptiles, we observe the same general likeness—those of the turtles all resemble each other, as do those of the serpents. The ova of batrachians approach more nearly those of fishes in appearance, but they still preserve a general and characteristic similarity.

The ova of all of the true fishes are spherical in form, though in some of the related or lower forms, they are oval or semi-elliptical. The ova of some species, as the salmon, brook trout, shad, etc., are separate and apparently smooth on the surface, like so many pellets of shot, while those of other species are provided with minute threads or filaments, by means of which they become attached to each other or to foreign substances. Some adhere singly to weeds or other objects, some float singly, some sink to the bottom singly, while others are held together by strips and bands or masses of adhesive or glutinous material, by which they become attached to plants, sticks or pebbles, or float on or near the surface, and still others are carried about by the male fish in various places or receptacles of its body until they are hatched.

Not only do the ova of fishes differ very much in appearance, but there exists a great diversity in their size, and consequently in the number of eggs produced by the different species—thus in a marine catfish the ova are as large as robin eggs; in the salmon they are one-fourth of an inch, and in the brook trout three-sixteenths of an inch in diameter; in one of the gars they are, with their envelope, a fourth of an inch in diameter, while in the eel they are almost microscopic.

The number of eggs produced by a female fish varies according to its age and weight. In several species of familiar fishes the number of their eggs have been ascertained by careful and accurate calculations to be as follows: In the marine catfish (*G. felis*), from 10 to 30 eggs; brook trout, from 100 to 1,800; salmon, 5,000 to 15,000; black bass, 5,000 to 20,000; lake trout, average, 15,000; sea herring, 10,000 to 30,000; shad, 25,000 to 100,000; white fish, 20,000 to 70,000; pike, average, 100,000; mackerel, 300,000 to 500,000; Spanish mackerel, 300,000 to 1,500,000; halibut, 2,000,000; striped bass, 2,000,000; carp, average, 500,000; sturgeon, as many as 7,000,000; Cod, 9,000,000, while in the eel there are also several millions.

It has not been many years since all fishes were supposed to deposit their spawn upon the shoals of the sea-shores or upon the beds of shallow inland streams, where the ova rested until hatched; but we now know that many marine species deposit their eggs at the surface of the ocean, where they float until incubation is complete.

In 1864, Prof. G. O. Sars, of Norway, first discovered that the eggs of the cod floated at the surface. Since then the investigations of Prof. Alexander Agassiz and Mr. John A. Ryder have added largely to our knowledge of floating eggs. Mr. Ryder characterizes several types of buoyant ova: 1. Those in which the specific gravity of the yolk is diminished, as in the egg of the cod; 2. Those in which large oil-drops, in an eccentric position, aid in causing the eggs to float; 3. Those in which a very large oil-drop causes the ovum to float even in fresh water. The other conditions are: 1. That the egg be free and not adhesive, with a thin membrane, and, 2, That it be immersed in water having a greater density than 1.014.

Among the fishes which produce floating ova may be mentioned the cod, mackerel, Spanish mackerel, bonito, cusk, haddock, many of the flounders, etc. A very curious and interesting contrivance for causing ova to float on the surface, which otherwise would sink to the bottom, is that resorted to by the beautiful paradise fish, of China. The male fish constructs a floating raft by expelling from his mouth bubbles of air coated with a fatty secretion, which, collecting on the surface, cling together, until a raft of viscid scum, several inches in extent, is formed. After the eggs of the female are deposited and fertilized on the bottom, in the usual manner, the male collects them in his mouth and ejects them into this frothy receptacle, which he keeps in constant repair, and preserves its bouyancy by additional fatty bubbles, until the young fry are hatched out, which occurs in about two days. Another method for floating the ova is that of the *Lophius*, or goosefish—the eggs, numbering about 50,000, are inclosed in a ribbon-shaped, gelatinous mass about a foot wide and forty feet in length, which floats near the surface.

Among the fishes which produce adhesive eggs are the little black-head minnow (*P. promelas*) and the goldfish. The male black-head deposits the fecundated eggs singly upon the under side of leaves of water plants and watches them unceasingly until hatched. The ova of the goldfish are deposited singly upon the weeds and mosses in a similar manner.

The eggs of the yellow perch are held together in narrow strips or ribbons of a glutinous character. Adhesive eggs of other species, as the black bass, sunfishes, catfishes, etc., are deposited in masses in shallow nests or depressions on the bottom; and still others deposit their spawn in variously-shaped adhesive masses upon algæ, roots and submerged objects.

The eggs of the myxine, or hag, are oval in shape, enveloped in horny cases and provided at each end with short filaments terminating in triple hooks, by which they attach themselves to each other and probably to foreign objects.

Perhaps the most curious and *bizarre* of all fish ova are those of the oviparous sharks and rays, which are quadrangular horny capsules or cases, two or three inches in length, with long filaments at the corners, which coil about sea weeds and other objects.

These horny cases, in the Port Jackson sharks of the Pacific, are twisted into a spiral form.

In some of the flying fishes the eggs are entirely covered with delicate filaments which entwine with each other, and they are thus held together in considerable masses; and in a similar manner the eggs of the gudgeon (*Menidia notata*), of the Chesapeake Bay, are held together, there being four long and slender threads attached to one side of each egg.

You are all familiar with the polygamous, four-spined stickleback, the male of which species builds a cunning, basket-like nest between the upright stems of water plants, in which he induces his several wives to deposit their eggs, and which he watches and cares for until hatched. Some of the fishes of the gulf stream—notably, the *Antennarius*—build a kind of nest among the floating seaweed; also the snakehead fish (*Ophiocephalus*), of India, and a small catfish (*Callichthys*), of South America, construct nests of bits of waterweeds, in which the ova is deposited and carefully tended by the male.

Among the fishes which carry the ova in various portions of the body until hatched may be mentioned the marine catfish (*Galeichthys felis*) of our Southern coasts. The female deposits, in a slight depression in the sand, ten or twenty yellowish-white eggs as large as Malaga grapes, which are fecundated by the male and then taken into his mouth and placed between the leaves of his gills, where he retains them until the young are hatched and able to take care of themselves. At this time his pharynx is enormously distended and presents a very curious and comical appearance.

Agassiz, during his journey up the Amazon, discovered a species that incubated its eggs in the mouth, and Dr. Lortet gives some very interesting observations on the similar propagation of a species (*Tilapia simonis*), belonging to Lake Tiberius, in Palestine. The female deposits about two hundred eggs in a shallow excavation, which are first fecundated by the male and then taken, one after another, into his mouth, where they are retained in the buccal cavity, distending the cheeks in an extraordinary manner. The eggs hatch in several days, and the young fishes are pressed one against the other like the grains of a ripe pomegranate. The mouth of the father becomes so distended that his jaws can not meet, and he presents a very strange appearance. Some of the young continue to live and develop among the folds of the gills;

others have their heads turned toward the mouth of the parent and do not quit the sheltering cavity till they are about four inches long.

Prof. Jeffries Wyman, of Boston, describes a singular contrivance of a species of armored catfish (*Aspredo*) of South America. The male fish is provided, during the breeding season, with a numerous series of little stalks on the under surface of the abdomen, upon which the eggs are received and carried until hatched.

In the well-known *Hippocampus*, or sea-horse, a pouch is developed in the male, under the tail, in which the ova are placed and finally hatched, the young escaping through a small opening in the anterior part of the pouch. In the pipefish (*Siphostoma*) a similar pouch is developed in the male for the same purpose, but is formed by a fold of skin from each side of the trunk and tail, the free margins being united in the median line. In another allied fish (*Solenostoma*) the inner borders of the ventral fins unite with the skin of the body and form a large pouch for the reception of the eggs, where they are retained by numerous filaments arranged along the ventral rays.

In another queer species called the lumpsucker (*Cyclopterus lumpus*), the male digs a pit between the stones of the bottom of shallow portions of the sea, in which the female deposits several hundred thousands of eggs, which are tenderly watched over by the male until they are hatched, when the young attach themselves by their suckers to the body of the male, who carries them about with him until they are able to care for themselves.

It is worthy of notice that, in every instance mentioned of the ova being guarded and cared for, or transported in various receptacles on the body of the parent, it is the male fish that performs these various duties. The part of the female in the reproduction of its species seems to end with the deposition of the ova.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, OHIO.

By A. P. Morgan.

(Continued from Vol. X., p. 202.)

Class I.—Hymenomycetes. (Concluded.)

(Read by Title August 7, 1888.)

Order V.—Clavariei.

Hymenium not discrete from the hymenophore, amphigenous Fungi somewhat fleshy, vertical, simple or branched; never coriaceous or incrusting like those Thelephoræ which are similar in form.

As other fleshy fungi, very limited in number in this region.

TABLE OF GENERA OF CLAVARIEI.

1. Clavaria. Fungi fleshy, simple or branched.
2. Calocera. Fungi cartilaginous-gelatinous, horny when dry.
3. Typhula. Minute fungi, subclavate, with a filiform stipe.

Genus I.—Clavaria, Linn.

Fungi fleshy, branched or simple, subterete and without a distinct stipe. Hymenium contiguous, dry, homogeneous.

* *Branched.*

A. Spores white.
    a. Terrestrial, 1–7.
    b. Lignatile, 8, 9.
B. Spores ochraceous.
    c. Terrestrial, 10–13.
    d. Lignatile, 14, 15.

** *Simple.*

e. Cæspitose, 16–18.
f. Distinct, 19, 20.

I. Ramaria. Branched, the branches tapering upward.

A. Spores white or pallid.

a. Growing on the ground.

1. C. FLAVA, Schaeff. Fragile. Trunk thick, fleshy, white, very much branched; the branches terete, even, fastigiate, obtuse, yellow.

On the ground in woods; rare. Three to 4 inches high, with the trunk an inch in thickness. Spores pale or with a yellowish tint.

2. C. BOTRYTES, Pers. Fragile. Trunk very thick, unequal, very much branched; the branches turgid, unequal, somewhat wrinkled, the apices red.

In beech woods; rare. Three inches or more in height, the trunk 1–2 inches in thickness. Color variable white, yellow and flesh-color.

3. C. MUSCOIDES, Linn. A little tough, somewhat delicate, yellow, two or three times forked; the stipe slender; the branchlets crescent-shaped, acute.

In grassy woods; rare. One and one-half to 2 inches in height, the slender stems scarcely an eighth of an inch in thickness. A very pretty and delicate species.

4. C. CRISTATA, Pers. Tough, even, stuffed, white, the branches dilated upward, acutely incised, crested.

In woods growing on the ground among the old leaves; not uncommon. One to 2 inches in height. This is said to be an exceedingly variable species; our plant has the trunk white and the branches cinereous, but it is plainly this species.

5. C. RUGOSA, Bull. Tough, simple or sparingly branched, thickened upward, wrinkled, white; the branches deformed, obtuse.

In damp places in woods; rare. One to 2 inches in height; very variable in shape, sometimes simple and clavate, sometimes divided into 2–4 variously unequal branches. *C. fuliginea*, Pers. is a sooty variety of this species.

6. C. KUNZEI, Fr. Somewhat fragile, cæspitose from a slender base, very much branched, pure white; the branches elongated, crowded, repeatedly forked, fastigiate, even, equal, compressed at the axils.

On the ground in woods; common. One and one-half to 2 inches in height. A beautiful species, growing in clusters, shining white.

7. C. SUBTILIS, Pers. Scattered, delicate, rather tough, whitish; the base glabrous, of equal thickness throughout; the branches few, forked, somewhat fastigiate.

On the ground in woods; rare. One and one-half to 2 inches in height. Simple or with a few branches *b. Growing on trunks.*

8. C. PYXIDATA, Pers. Pallid then alutaceous and subrufescent. Trunk slender, glabrous, branched; the branches and branchlets all cup-shaped at the apex; the cupules proliferous-radiate at the margin.

On rotten wood; rare. Sometimes in clusters of considerable extent, 3–5 inches in breadth and height; the branchlets obconic, even; the cupules repeatedly verticiilate-proliferous, the terminal ones dentate.

9. C. CORONATA, Schw. Pale yellow then fawn color, divided immediately from the base and very much branched; the branches divergent and compressed or angulate, the final branchlets truncate-obtuse at the apex and there encircled with a crown of minute processes. See Plate II, Fig. 1.

On rotten wood; common. Repeatedly dichotomously or verticillately branched and forming clusters sometimes several inches in height and extent. Resembling in form the preceding, but a distinct species.

B. Spores ochraceous or cinnamon.

c. Growing on the ground.

10. C. AUREA, Schaeff. Trunk thick, elastic, pallid, divided into stout, straight branches, which are dichotomously very much branched; the branchlets terete, obtuse, subdentate, yellow.

On the ground in woods; rare. Three to 4 inches high with the trunk an inch in thickness. Resembling *C. flava* but very distinct from it by reason of the differently colored spores.

11. C. FORMOSA, Pers. Trunk thick, elastic, whitish; the branches very much branched, elongated, orange rose-color; the branchlets obtuse, yellowish.

On the ground in woods; rare. Three inches or more in height, the trunk an inch in thickness.

12. C. INCURVATA, Morg. n. sp. Fragile. Trunk thick, fleshy, white; branches ochraceous, dichotomously very much branched; the branchlets spreading, somewhat flexuous, rugulose, the apices dentate. See Plate II., Fig. 2.

On the ground in woods; rare. Trunk white, an inch and a half in height and 1 inch thick; branches and branchlets ochraceous, 2–3 inches longer, with an extent of 3 or 4 inches. The peculiar feature is the spreading branches curving outward and upward.

13. C. ABIETINA, Pers. Very much branched, ochraceous. Trunk white-tomentose, rather thick; branches crowded, when dry longitudinally wrinkled; the branchlets straight, acute.

On the ground in woods; not rare. Two to 3 inches in height, the trunk short, less than half an inch in thickness. The branches are erect and very close together.

d. Growing on trunks.

14. C. STRICTA, Pers. Very much branched, pale yellowish, brownish when rubbed, the trunk rather thick; branches and branchlets straight, even, crowded and oppressed, acute.

On old trunks; common. Two to 3 inches in height. Fibrillose-rooting at the base; the trunk very short; the branches straight, erect, pressed close together.

15. C. CRISPULA; Fr. Very much branched, alutaceous then ochraceous, the trunk slender; branches flexuous, multifid, the branchlets divaricate.

On old trunks; common. One to 2 inches in height. Rooting at the base by long white fibrils; the trunk very short; the branches repeatedly forked and flexuous, even to the tips.

II. SYNCORYNE. Simple, cæspitose at the base or fasciculate.

16. C. FUSIFORMIS, Sow. Cæspitose-connate, rather firm, yellow, soon hollow; clubs somewhat fusiform, simple and dentate, even, tapering to the base.

On the ground in grassy places; rare. Club 1–2 inches long, 1–2 lines thick above and tapering downward to the base. Readily distinguished by its yellow color, but it finally becomes brownish at the apex.

17. C. VERMICULARIS, Scop. Cæspitose, fragile, white; clubs stuffed, simple, cylindric, subulate.

On the ground in grassy places; rare. Clubs 1½–3 inches in height, about a line in thickness, cylindric. Larger than the following species; often flexuous or incurved.

18. C. FRAGILIS, Holmsk. Fasciculate, very fragile, white below, tapering downward; clubs hollow, a little obtuse, variable.

On the ground in woods; rare. Varying much in size and thickness; sometimes attaining a height of 3 inches, but usually shorter, very slender and fragile. Commonly white, but sometimes yellowish, especially at the apex, but always white next the base.

III. Holocoryne. Mostly simple, distinct at the base.

19. C. pistillaris, Linn. Simple, large, fleshy, stuffed, obovate-clavate, obtuse, yellow, then rufescent.

On the ground in woods; rare. Very large, solitary or only a few together; the club attaining a length of 6 inches or more and a thickness of about an inch at the summit, the color rather variable growing darker with age.

20. C. mucida, Pers. Gregarious, minute, simple or sparingly ramose-incised, even, naked, white, becoming yellowish, glabrous, substipitate.

On old damp logs; very common in all seasons. Usually growing on a thin greenish stratum, *Chlorococcus*, very small, scarcely exceeding half an inch in height.

Genus II.—Calocera, Fr.

Fungi gelatinous-cartilaginous, horny when dry, vertical, subcylindric, simple or branched, viscid, without a distinct stipe. Hymenium amphigenous, sporophores two-forked; spores oblong, curved.

1. C. palmata, Schum. Branched, tremellose-tough, orange-yellow, compressed, dilated upward, divided; the branchlets subterete, divaricate, obtuse.

On oak wood; rare. About half an inch in height, with a flattened stem, branched and forked toward the summit.

2. C. cornea, Batsch. Cæspitose, rooting, even, viscid, yellow-orange; clubs short, subulate, connate at the base.

On old wood; common. About one-quarter of an inch in height, consisting of many single individuals fused together at the base; rooting in the cracks of the wood and growing out of them.

3. C. stricta, Fr. Simple, solitary, elongated, blunt at the base, linear, yellow even when dry.

On old wood; common. One-half to 1 inch in length; encircled at the base by a white delicate tomentum. It differs from the preceding species in its scattered mode of growth and slender habit; two or three individuals occasionally spring from the same spot, but they are never extensively confluent. This is evidently the same species as *Clavaria albipes*, Mont., described in the *Annales des Sciences Naturelles*, October, 1842, p. 14. It was collected at Columbus, Ohio, by Mr. Sullivant and communicated to Montagne through Dr. Asa Gray. It appears as *Calocera albipes* in Berkeley's Notices N. A. Fungi under No. 303.

Genus III.—TYPHULA, Pers.

Fungi minute, tender; stipe filiform, either heterogeneous and distinct from the linear club, or springing from a sclerotioid hybernaculum. Hymenium waxy, sporophores forked, spicules elongated. Fungi epiphytal.

1. T. MUSCICOLA, Pers. Simple, filiform; the club cylindric, obtuse, white, tapering into the slender, smooth stipe; hybernaculum even, pallid.

Growing on mosses; not uncommon. One-half to 1 inch in height. Our plant is smaller than the one described by Fries, but it is referred to this species by several authorities. It was also noted by Mr. Lea. Further than this the minute Clavariei appear to be absent from the Miami Valley.

Order VI.—TREMELLINEI.

The whole fungus homogeneous, gelatinous, shrinking when dry, reviving when wet, traversed internally by branched filaments which terminate at the surface in sporophores; spores subreniform.

TABLE OF GENERA OF TREMELLINEI.

a. Hymenium over the whole outer surface.

1. TREMELLA. Gelatinous-distended, tremulous, immarginate, not papillate.

2 EXIDIA. Gelatinous-distended, tremulous, submarginate, papillose.

3. NÆMATELIA. Convex, immarginate, a firm nucleus covered by a thick gelatinous stratum.

4. DACRYMYCES. Gelatinous, homogeneous, conidia moniliform-concatenate, spores septate.

b. Hymenium on one side only.

5. HIRNEOLA. Cartilaginous gelatinous, the hymenium superior

6. GUEPINIA. Cartilaginous-gelatinous, stipitate, the hymenium unilateral.

Genus I.—TREMELLA, Dill.

Fungi distended with jelly, tremulous, immarginate, not papillate; sporophores globose, becoming four-parted, putting out from each part an elongated free spicule terminated by a simple spore.

I. MESENTERIFORMES. Cartilaginous-gelatinous, foliaceous, naked.

1. T. FOLIACEA, Pers. Cæspitose, even, undulate, cinnamon-flesh-color, the base plicate.

On old trunks; common. Clusters 1–2 inches in height and sometimes several inches in extent. The lobes very thin, undulate and crisp when dry.

2. T. LUTESCENS, Pers. Cæspitose, very soft, undulate-gyrose, yellowish; the lobes entire, naked.

On fallen branches; common. Clusters ½ to 1 inch in breadth, whitish, then pale yellowish, very soft and watery, leaving little residue when dried.

II. CEREBRINÆ. Compact, then pulpy, subpruinose with the spores.

3. T. MESENTERICA, Retz. Simple, ascending, rather tough, various in form, plicate-undulate, gyrose, orange color.

On oak branches; not common. Sometimes an inch or more in extent, but it varies exceedingly in size and shape, so that there is no constant form; it may easily be distinguished, however, by the orange color and the surface extremely sulcate-plicate and gyrose.

4. T. INTUMESCENS, Sow. Subcæspitose, rounded or conglomerate, soft, brown, becoming black when dry, somewhat twisted and lobed.

On dead branches of willow; common. An inch or two in extent, when fully grown it consists of numerous round, soft, pulpy lobes. It is black when dry, and resembles *Exidia glandulosa*, but there are no papillæ upon the surface.

5. T. VESICARIA, Eng. Bot. Erect, firm, gelatinous within, undulate and gyrose, pallid; spores oblong, curved, .010–012 mm. long.

On the ground encircling sticks, the bases of herbaceous stems, etc.; not uncommon. Often in shape of a hollow stem and branches 2–4 inches in height, becoming hard and horny when dry. It is *Guepinia helvelloidea*, Schw. N. A. Fungi, No. 1085.

6. T. ALBIDA, Huds. Ascending, tough, expanded, undulate, subgyrose, pruinose, whitish, becoming brownish when dry; spores oblong, curved, .008–.009 x .005 mm.

On old trunks in summer; common. An inch or two in height and confluent for several inches. Possibly our white Tremella is different from the European species.

Genus II.—Exidia, Fr.

Fungi distended with jelly, tremulous, somewhat marginate, papillose; a colored gelatinous stratum inclosing the sporophores, the spicules of which are erumpent only at the apex.

1. E. truncata, Fr. Soft, distended with jelly, disk truncate-plane, glandular, black, shining, at length cavernous, punctate-scabrous underneath; stipe very short; spores oblong, curved, .012–.014 mm. in length.

On oak branches; common. An inch or less in height and breadth. When dry very thin and intensely black, the glands seldom apparent.

2. E. glandulosa, Bull. Effused, nearly plane, thick, undulate, becoming black, spiculose with conic papillæ, the underside cinereous and somewhat tomentose; spores oblong, curved, .012–.014 x .005 mm.

On old trunks and branches; very common. Extremely variable in form and size; usually rather flattened and effused, sometimes for several inches. Sometimes becoming pallid on the underside or inside of trunks away from the light The papillæ can be plainly seen with a common lens. In England it is called "Witch's Butter."

Genus III.—Næmatelia, Fr.

Fungi consisting of a firm fleshy nucleus, inclosed by a thick gelatinous stratum, fibrous-floccose within, the whole surface covered by the sporophores.

1. N. nucleata, Schw. Effused, plane, somewhat gyrose and undulate, white, then rufescent; the nucleus small, hard, white spores oblong, curved, .010 mm. in length.

On old trunks of *Acer saccharinum* under the bark and erumpent from the cracks: common. Effused sometimes for several inches, folded and wrinkled. The gelatinous portion shrinks to a mere membrane in drying, leaving the white grains, as large as mustard seed, quite conspicuous. This seems different from the European species which are termed "solid, not collapsing by dryness."

Genus IV.—Dacrymyces, Nees.

Fungi gelatinous, homogeneous, traversed within by septate fibers; conidia moniliform-concatenate; sporophores at the apex of the filaments, clavate, two-forked when fully grown; spores septate.

1. D. FRAGIFORMIS, Nees. Rather compact, round, red, somewhat lobed and folded.

On old wood; common. Round, red, gelatinous, but quite firm; sometimes confluent for an inch or two, retaining the deep red color when dry. The threads are moniliform-septate, they are readily set free in water.

2. D. DELIQUESCENS, Bull. Roundish, rooted, convex, immarginate, yellowish; at length twisted and hyaline. Spores three-septate.

On old wood; rare. At first of a dirty yellowish color, then growing pallid, when dry, brownish-yellow.

3. D. STILLATUS, Nees. Roundish, convex, at length plicate, yellow, then orange, the color persistent. Spores multiseptate.

On old wood; rare. Distinguished from the former by its persistent bright color. I usually find the spores multinucleate.

4. D. CHRYSOCOMUS, Bull. Orbicular, golden-yellow; the younger spheric, immarginate, soon collapsed and pezizoid; at length flattened and persistently even. Spores multiseptate.

On old wood; not uncommon. Looking like a small Peziza, in which genus it was originally placed, but there are no asci. Spores multinucleate, .015 mm. in length.

5. D. PELLUCIDUS, Schw. Gyrose and variously lobed, the lobes thick and obtuse, somewhat pellucid, white. Spores three-septate, .012–.015 mm. in length.

On old trunks; not common. Large, an inch or two in length and breadth, and resembling a Tremella in form. In the dry state it becomes a thick, hard membrane, plicate-venose and pellucid.

Genus V.—HIRNEOLA, Fr. *Jew's Ear.*

Fungi cartilaginous-gelatinous, soft and tremulous when wet, but not distended with jelly; when dry coriaceous-horny, reviving again when moistened, but scarcely swelling. Hymenium superior; spores continuous, oblong, curved.

1. H. AURICULA-JUDÆ, Linn. Sessile, concave, flexuous, thin, at length black, venose-plicate on both sides, tomentose and olivaceous-cinereous underneath. Spores oblong, curved, .014–.016 mm. in length.

On old trunks and branches of Hickory and other wood; common and abundant. Often growing cæspitosely, 1–3 inches in height and breadth. The hymenium growing black in drying, the opposite side becoming cinereous or olivaceous; the folds or veins become quite conspicuous.

2. H. AURIFORMIS, Schw. Substipitate, concave, flexuous, thin, venose, glauco fuscous; somewhat pubescent underneath. Stipe lateral short, twisted, sulcate-lacunose. Spores oblong, curved, .014–.016 mm. in length.

On trunks and branches of Walnut; common. Two to 3 inches in length and breadth. The hymenium does not grow black as in the preceding species, and the pubescent underside has a tawny or brownish hue.

Genus VI.—GUEPINIA, Fr.

Fungi cartilaginous-gelatinous, free, various in form, substipitate. Hymenium on one side only; sporophores linear, long-forked, bisporous; spores septate, curved.

1. G. SPATHULARIA, Schw. Nearly erect, stipitate, spathulate, the stipe and upper side cinereous-pubescent. Hymenium plicate, orange-yellow; spores curved, apiculate, three-septate, .010–.012 mm. in length.

On old wood; common. Growing cæspitosely and rooting in the cracks of the wood, often in a linear series, nearly an inch in height. The delicate nerves or folds of the hymenium are decurrent upon the stipe.

2. G. ELEGANS, B. & C. Nearly erect, stipitate. Pileus orbicular or fan-shaped, tawny as well as the stipe. Hymenium plicate, brownish-amber colored; spores curved, apiculate, three-septate, .015–.018 mm. in length.

On wood of Elm; not common. Growing cæspitosely, often lobed and confluent, nearly an inch in height. The fine pubescence is tawny or rufescent; the well-developed hymenium is plicate with decurrent folds and becomes blackish with age.

3. G PEZIZA, Tul. Cupular, nearly sessile; glabrous both sides, yellow, adnate behind. Stipe slender. Hymenium superior; spores three-septate, .010–.012 mm. long.

On old wood; rare. Cup shaped, concave, 3–5 mm. broad. It looks like a small Peziza, and is not likely to be found except when collecting these small fungi.

AN ANCIENT CHANNEL OF THE OHIO RIVER AT CINCINNATI.

By Prof. Joseph F. James, M.S.
Agricultural College, Md.

(Read September 4, 1888.)

In the human race, animal life has attained its culminating point on the earth; and as an heir to the ages man is a debtor to the past. No geological period has come and gone but has left something which man has been able to turn to his advantage. The stores of oil and gas, for which Ohio has lately become famous, have resulted from the decomposition of the animal life which existed in the far-away period of the Trenton. The limestones and sandstones laid down in the Palæozoic Ages have been useful in building man's houses and in sheltering him from the weather. The coal resulting from the vegetable growth of the Carboniferous Era enables him to exist in the colder regions of the earth, and so carry on his wonderful manufacturing industries in all parts of it. The stores of iron, lead, copper, zinc and tin, have enabled him to establish these manufactories, and so girdle the earth with bands of iron and wires of steel. The mines of precious metals have given him objects of ornament and of use, and have served him, in his more civilized state, as mediums of exchange.

It is not alone to long past ages that man owes much that makes life bearable. More recent times have wrought great changes in the surface of the earth. Even now the disintegrating effects of rain, frost and other atmospheric agents are seen in the formation of the soil which he tills, and from which he secures his sustenance.

The different geological periods have served different purposes; but all of them have contributed more or less to man's happiness or comfort. The last great period in the earth's history is not the least important of all, and perhaps in some senses it may be the *most* important.

It should be remembered that the larger part of the State of Ohio has been exposed to erosion by atmospheric agents since the close of the Carboniferous. The result of this erosion has been partly made known in Ohio by the very extensive series of drillings which have been made to discover oil and gas. We know from these investigations that at a not very remote period, geologically speaking, the southwestern, the central and the northern parts of of the State were cut up in much the same manner, though on a smaller scale, as the Colorado Plateau region now is. Deep cañons alternated with narrow ridges of land; or wide valleys swept in majestic course for miles, bordered on either side with steep declivities or abrupt precipices. The mass of debris brought by the glaciers, or resulting from their erosive powers, has filled up the narrow cañons and wide valleys; has buried the perpendicular cliffs to their summits in sand, gravel and clay; and has left rounded hills or has formed level plains, upon which now stand the residences of civilized man. The amount of money expended in the search for oil and gas is scarcely proportionate to the pecuniary return; but the result from a scientific standpoint has been most valuable. One thing, at least, it has shown us, and that is, how much we owe to the recent past. Without the action of the glaciers in grinding the rocks up, or tearing away the disentegrated surface material; without the mixing up of the many ingredients which now form our soil, it may be questioned whether the State would ever have produced the crops which it has. Without the filling of valleys and the rounding of hills, it may be questioned whether Ohio would ever have attained the position she has in the galaxy of States.

The valleys of the Ohio River and its tributaries are in many instances terraced in a peculiar manner. Upon these terraces have been built many cities. Among these are Cincinnati, Hamilton and Columbus, Ohio, and Louisville, Covington and Newport, Kentucky. It is to the surroundings of one city, Cincinnati, as influenced by comparatively recent geological changes, that attention is now directed.

While most of our streams have occupied portions of their present valleys for long periods, there are others which have cut comparatively new courses for themselves. Still others that flow partly in the old and partly in a new channel, cut since the beginning, or perhaps even since the close, of the Glacial Era. The Ohio itself flows in part in an old and in part in a new bed. A portion of this old bed is now known as Mill Creek, an insignificant stream which empties into the Ohio, after flowing through the western side of Cincinnati.

In early days its waters were pure, and swarmed with fish of many kinds; but, with the growth of a great city along its banks and about its mouth, its waters have become so defiled as scarcely to permit the existence in them of any living thing. Breweries, glue factories, soap establishments, distilleries, stock-yards and slaughter-houses empty their refuse into its waters; and these, with numerous city sewers, have made the name of Mill Creek synonomous with foul smells and turbid waters. It is an unworthy descendant of the mighty river which carved out its broad and lengthy channel. For, while the creek scarcely exceeds in volume an ordinary canal, its valley is broad and extensive. Its usefulness is made manifest by the railroads which traverse it to enter Cincinnati. The Cincinnati, Washington and Baltimore, the Cincinnati, Hamilton and Dayton, the Cincinnati and Sandusky, the Erie, the Cincinnati, Cleveland, Columbus and Indianapolis, and the Cincinnati Southern all find modes of ingress and egress by it.

The Miami Canal, too, follows its course for twenty-five miles. It is the only entrance to Cincinnati from the north, because of the hills that extend far to the eastward. Without it, tunnels, cuts or inclined planes would have been necessary, or Cincinnati would now be an insignificant village.

The surrounding hills are formed of solid rock—the blue limestone of Lower Silurian Age that is quarried extensively for building purposes and for lime. These hills were once continuous across the Ohio River from Price Hill, on the north, to Ludlow, Kentucky, on the south, but the stream has forced a passage through them. The edges of the broad Mill Creek Valley are thus of rock, but its bottom is gravel, sand and clay. So much of the latter exists, and it is of such fineness, that hundreds of thousands of brick have been made from it. Below the clay lie extensive beds of sand and water-worn gravel. This has been reached and penetrated by several wells bored for gas or water, and the rocky character of the bottom has been revealed. One well bored at the foot of George Street, in the western part of Cincinnati, shows forty-eight feet of sand and gravel overlying the rock. This rock is twenty-three feet above low water in the Ohio River at present. This is probably on the edge of the valley; likely in the center the drift is much deeper. Farther north, in the suburb of Cumminsville and nearer the center of the valley, the bed-rock was sixty feet below present low water in the Ohio.* In a second well at Cumminsville, one hundred and twenty feet were penetrated before bed-rock was reached.†

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* Ohio Geology, I., 433. † Ibid, II., 13.

Again in a well at Ivorydale, a few miles to the northward, records show ninety-eight feet of drift, gravel, sand and clay above bed-rock, or thirty-four feet below low water-mark. Lastly, at Hamilton, twenty-five miles north of Cincinnati, two wells have penetrated the drift two hundred and two hundred and fourteen feet, respectively, before reaching bed-rock. In other words, the rock here is in one case seventy-seven and in the other case ninety-one feet below low water in the Ohio, so that there is a descent in the rocky bottom of Mill Creek from Cincinnati northward to Hamilton. This is the case *below* the ground, although, at the surface, Hamilton is one hundred and twenty-three feet higher above the sea-level than Cincinnati—the heights being four hundred and forty and five hundred and sixty-three feet, respectively.

The consequences of this difference in level of the rock-bed are easily seen. The Ohio River, instead of passing Mill Creek in its present channel, was barred by the land barrier extending from Price Hill to Ludlow, and swept around the southwestern part of the Cincinnati Terrace, took a northward course to about where Hamilton now stands, along the channel now occupied by Mill Creek, and received the waters of the Big Miami at that point. Thence it flowed southwest along the present valley of the Miami, and regained its present channel, and its ancient one too, at Lawrenceburg, Ind.

But this is not the whole story of the ancient course of the Ohio near Cincinnati. The eastern end of the city lies along the base of an abrupt hill, which continues almost up to Columbia, while the hills of Kentucky are not far from the river bank on the other side. Above Columbia is the mouth of the Little Miami River, in a wide bottom, three or four miles across, and extending northeast. As far up as Plainville, nine miles from Cincinnati, the rise of the ground is very gradual, there being a difference in level of only fifty-two feet. Between a hill west of Redbank Station and another one east of Plainville, a distance of two and a half miles, no rock is exposed at the surface; all is drift material. This fact points to the existence here of an ancient arm of the Ohio River, now entirely choked up. At Redbank is an immense deposit of gravel at least fifty feet above the bed of the river and of unknown depth. At Batavia Junction the deposit is probably one hundred feet above the river. Part of this deposit is clay and sand, so fine as to form excellent molding sand. Part again is a conglomerate of coarse gravel. These deposits mark the ancient junction of the Little Miami and Ohio Rivers.

Following Duck Creek, a small tributary of the Little Miami heading northward, we find at Madisonville, a wide, open valley, evidently the site of an ancient lake or expansion of the Giant River. The Rock is exposed on the eastern side of the valley. Still farther north the valley merges into that of Mill Creek, near Ludlow Grove. Thus, the Ohio surrounded the high ground upon which the suburbs of Walnut Hills, Mt. Auburn, Avondale and Clifton are situated. Here at Ludlow Grove is an immense accumulation of water-worn gravel, probably the resulting deposit from the meeting of two bodies of water on the east and west of the island. The extent of the gravel deposit and the depth to which the channel was excavated, are evidences of the presence of large bodies of water for long periods of time.

To still further prove that here probably lay the ancient channels of the Ohio, and that the present channel *past* Mill Creek is of much more recent date, is the fact that west of the mouth of this stream the water of the Ohio flows over the bedded rocks. These are exposed, at low water along the bank, near Ludlow, Kentucky, and on the Ohio side near Price Hill, and even at the mouth of Mill Creek, in all probability extending across the river's bed. While this is the case at this point, near Mill Creek, the river piers of the new Chesapeake and Ohio railroad bridge, about a half or three-quarters of a mile up stream, rest upon rock beneath sixty feet of sand and gravel. It seems, therefore, that the present channel of the Ohio below the mouth of Mill Creek is of comparatively recent date.

At Ludlow, Kentucky, upon the slope of a hill above the Ohio s an extensive deposit of reddish, sandy clay. The rock is exposed at the top and at the bottom of the hill, but is hidden between by this clay deposit. Farther up the river a similar deposit forms a hill of considerable size just back from the river bank.

The inference to be drawn from these facts is, that previous to the glacial period a barrier of land extended from Price Hill on the north to the mouth of the Licking River on the south, preventing the westward flow of the Ohio, and forcing it north and northwest along the channels of Mill Creek and Duck Creek. These met at Ludlow Grove and together continued north to Hamilton. Here entered the Big Miami,* and the united streams continued in great volume southward to the present channel of the Ohio, at Lawrenceburg.

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* There is at this point also an enormous amount of gravel, which has been extensively used by the railroads.

At the coming on of the Glacial Period a tongue of ice projecting down the valley from the north and surrounding the "Cincinnati Island" as we may call that high land now covered with suburban homes, forced the water of the Ohio southward, over the watershed of the Licking, possibly into what is now the Kentucky River gorge. This course was pursued for an indefinite period; but, when the ice had retired, the river returned to its own channel near Cincinnati. Finding, however, its outlets to the north choked by debris of the glacier, and the former barrier of land between Price Hill and the mouth of the Licking lowered or cut away, it followed the line of drainage it holds at the present time.

If the eye of savage man gazed upon the site of Cincinnati before the Age of Ice, he beheld a vastly different scene from what he would behold now. Standing on the highest point of Mt. Auburn he looked south over a deep, rocky gorge, through which rolled the mighty Ohio. On the west was the rocky shore of Price Hill extending in an unbroken line north and south to Kentucky. The Licking River entered as a tributary here. On the east was another waste of water rolling its dark tide northward, and joining the western branch beyond the hills of Clifton. No broad expanse of valley nor of rolling plain lay beneath him; no city was there, teeming with life and humming with industry; no railroad trains were panting and puffing, holding their way toward sites of unknown towns. But the water swiftly, with sullen roar, reëchoing from cliff to cliff pursued its journey toward its unknown grave. No steamer plowed its waters, but dug out or canoe probably carried primitive man from camp to camp, or shore to shore. Where once the imaginary savage stood are now palatial mansions. Where once the waters spread their turbid tide is now a busy city of 400,000 people The water which was once cleft only by the prow of frail canoe is now a highway for many floating palaces Where once the stream pursued its northward course, the iron horse carries thousands daily to and from their homes in the wide and fertile Mill Creek Valley. Never would all this have been, had not the Glacial Period wrought its wondrous change. But the ice filled the valley and forced the river from its course. When permitted to return, the ancient channel was so filled with debris that a new one must be cut out, leaving the old one to be utilized by man as a way for his iron servant and as a place whereon to build his cities.

THE IVORYDALE WELL IN MILL CREEK VALLEY.

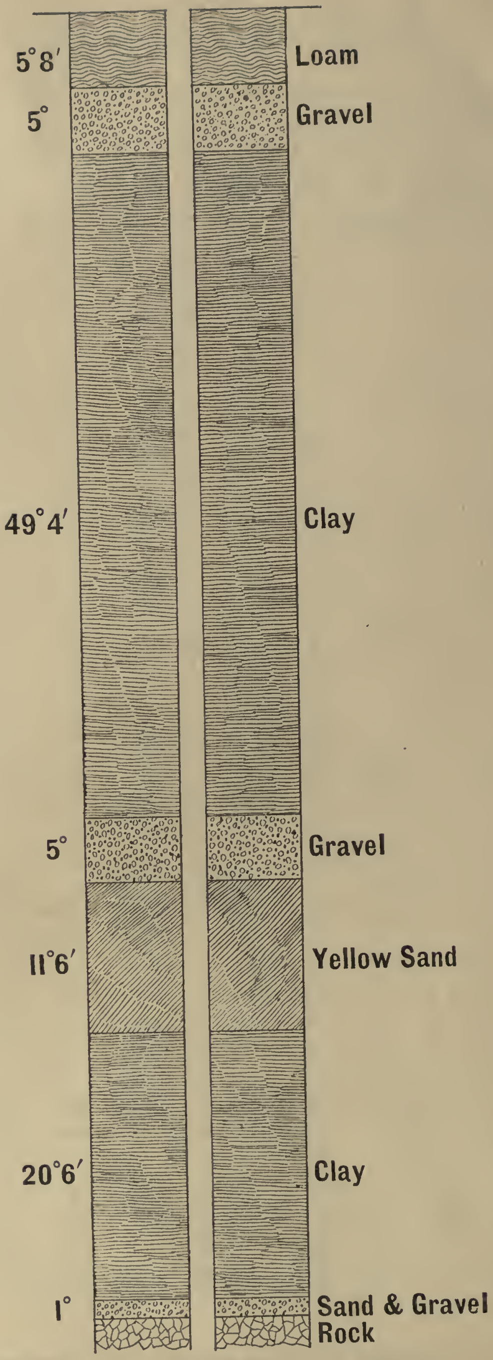
BY PROF. JOSEPH F. JAMES, M.S.

Read September 4, 1888.

"Ivorydale" is the name given to the soap and candle manufacturing establishment of Procter & Gamble in Mill Creek Valley a few miles north of the city of Cincinnati. About a year and a half ago the company dug a couple of wells at their works to secure a supply of water for various purposes. A record of the material passed through before the rock was reached is of interest, as showing the depth of the drift deposit and of the extent of the excavation of the channel. Believing that records of this character are of value, as indicating the extent of the erosion of the earth's surface previous to the Glacial Period, this record is now brought before you.

The mouth of the well in question was 74 feet above low water in the Ohio River, but as a fill of 5 feet had been made in some time past, the original surface was 69 feet above low water. In the drilling, loam was found to be 5 feet 8 inches in depth. Below this lay a bed of gravel 5 feet thick. Next came a very heavy deposit of clay, the drill penetrating 49 feet 4 inches before getting through, and reaching below another five-foot deposit of sand and gravel. Then came 11 feet 6 inches of "yellow sand" (so called), and beneath this 20 feet 6 inches of clay. A foot of gravel and sand lay upon the bed-rock, which was thus found 98 feet below the original surface of the ground.

The interest of the record lies in the extreme thickness of the clay deposits. These aggregated 70 feet, while the gravel and sand aggregated 22 feet 6 inches. The question presents itself, Do these two deposits of clay, separated by a five-foot stratum of gravel and sand, represent two successive glacial periods? Or, does the second deposit of 49 feet of clay indicate a gradual sinking of the ground so as to permit of this accumulation? While the existence of a great accumulation of drift material in the Mill Creek Valley has long been known, I believe this is the first time even an approach to a detailed account has ever been made. I am indebted for the information here given to Mr. James N. Gamble, of Ivorydale. The accompanying section, drawn to a scale five feet to an inch, is made from a blue print sent to the writer by Mr. Gamble.



SECTION OF IVORYDALE WELL

TREASURER'S REPORT

CINCINNATI SOCIETY OF NATURAL HISTORY,

For the year ending April 3, 1888.

Corrected.

Receipts.

From dues and initiation fees,		$ 696 00
From interest on investments,		2,557 91
From subscriptions to Journal and sales,		29 0
From Cope's Lecture for Building Fund,		31 85
Total received for general income,		$3,314 82
From investments collected, viz.:		
Sale of 4% City Bonds to reinvest,	$3,500 00	
Loan to W. F. Orange paid in.	1,500 00	
Loan to C. J. Coleman paid in,	7,000 00	$12,000 00
		$15,314 82
There was a balance on hand at the beginning of the year April 1, 1887 (most of it for reinvestment), of		$ 1,812 79
		$17,127 61

Payments.

Salaries to Janitor and Custodian. $546.00—$670.00,		$1,216 00
Printing four numbers Journal,		434 15
Museum and Library, $70.42—$22.90,		93 32
Expenses Course of Lectures,		40 10
Printing, Stationery and Postage for Secretary, Treasurer, Custodian and Committees,		107 07
Other expenditures by the Custodian,		39 72
House repairs and furniture,		60 25
Book-case,		52 00
Apparatus for illustrating lectures and exhibitions:		
Lantern,	$75 00	
Cylinders for Calcium Light,	50 00	125 00
Water, $15 30; Gas, $25.91; Fuel, $95.75,		136 96
Miscellaneous expenses,		66 76
Carried forward,		$2,371 33

	Brought forward,	$2 371 33
Loans made April 22 to M. Byrnes,	$4,000 00	
Loans made September 19 to A. Castelo,	1,000 00	
Loans made November 23 to Blymyer Bros.,	8,000 00—	$13,000 00
Cash balance,		1,756 28
		$17,127 61

The number of members on the roll herewith is,	169
The number paid up to date,	135
Resigned,	4
Deceased,	2
The number in arrears for one year, or part of a year,	31
Amount due from them,	$142 75
The number in arrears for two years is,	5
Amount due from them,	$46 50

These are subject to be dropped.

Respectfully submitted,

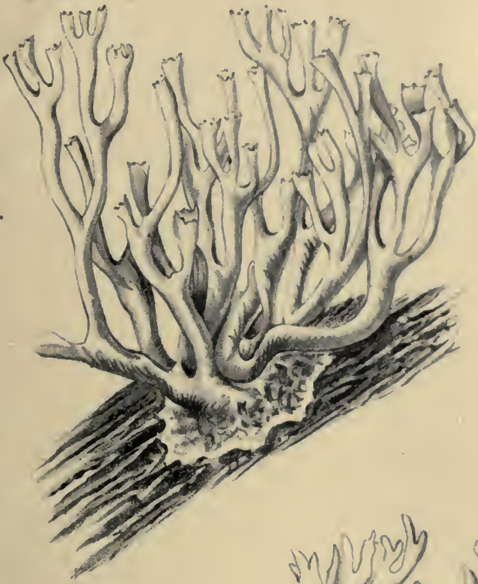
S. E. WRIGHT, Treasurer.

CINCINNATI, *May* 30, 1888.

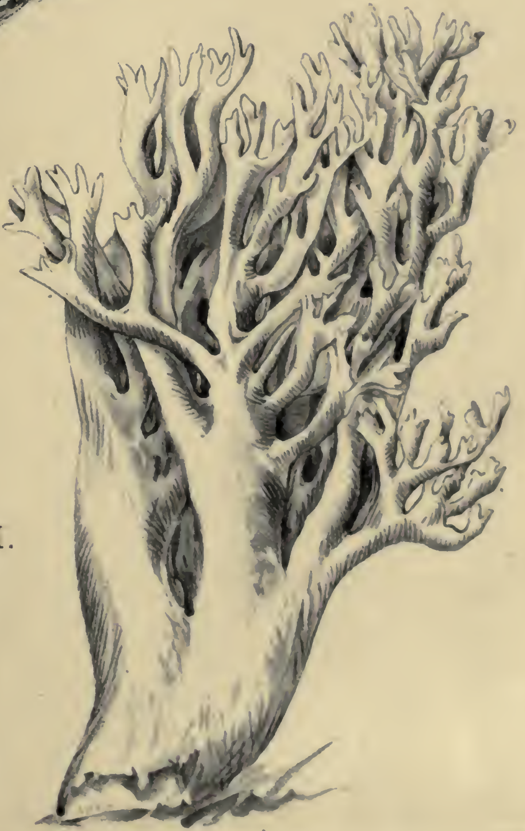
We, the undersigned, a Committee appointed by the Cincinnati Society of Natural History, to audit the Annual Report of the Treasurer of said Society for the fiscal year ending April 1, 1888, do hereby certify that we have examined said report and find the same correct.

DAVIS L. JAMES,
WM. HUBBELL FISHER, } *Committee.*
WM. H. KNIGHT,

I.



II.



1. {Clavaria coronata, Schw.}

11 {Clavaria incurvata Morg.}

THE JOURNAL

OF THE

Cincinnati Society of Natural History

Vol. XI. CINCINNATI, JANUARY, 1889. No. 4.

PROCEEDINGS.

Business Meeting, *October* 2, 1888.

Vice-President Wm. Hubbell Fisher in the chair.

Minutes of the July business meeting were read and approved.

Minutes of the Executive Board for meetings of July, August and September were read.

Sergt. P. T. Jenkins, U. S. Signal Service, was elected to active membership.

Dr. O. D. Norton was elected Curator of Botany, in place of Prof. Jos. F. James, resigned.

Prof. Thomas Wilson, of the Smithsonian Institution, having applied for the loan of certain pathological specimens of bones, the matter was referred to the Curator of Anthropology, with power to act.

A very interesting collection of Archæological and other specimens, donated by the U. S. National Museum, were exhibited.

Dr. Norton made some remarks on the water-plants in the fountain at Union Square, New York.

Wm. Norris Davis, of Philadelphia, was proposed for Corresponding Membership, by the Executive Board.

Dr. A. J. Howe read a paper, entitled "Depressions in the Earth's Surface," which elicited remarks from Dr. Norton, Mr. Knight and others.

Dr. Norton exhibited a specimen of Spodumene.

Donations were received as follows: From W. W. Dawson, M.D., City, Cocoon of Samia cecropia; from Prof. Jos. F. James, diagram (in frame) of Oxford Gas Well, section of same in glass tube; from L. H. Duwelius, M. D., fossil vertebræ, etc., from "Bad Lands," Dakota; from C. W. Riggs, charred grass cloth.

Adjourned.

SCIENTIFIC MEETING, *November* 4, 1888.

President Skinner in the chair. Nine members present, but several more came in afterward.

Minutes of September Scientific Meeting read and approved.

It being the night of the election of the President of the United States, and a great deal of noise and confusion being in the streets, the reading of Col. Abert's paper was postponed for one week.

A letter from Mr. W. T. Garratt in relation to the donation of specimens of minerals from the California State Mining Bureau, and enclosing a receipted bill for freight on same, was read by President Skinner.

On motion the Executive Board was instructed to remit the amount of the freight bill to Mr. Garratt.

A vote of thanks was extended to Mr Garratt, for his praiseworthy efforts in obtaining this fine collection for the Society,

The following gentlemen were proposed for active membership: Dr. Ralph S. Michel, J. M. Newton, Dr. B. F. Beebe, Dr. Edwin Ricketts.

Wm. Norris Davis was elected to Corresponding Membership.

Mr. D. L. James read a letter from Dr. N. L. Britton, Secretary of the Audubon Monument Committee, acknowledging the receipt of $6.50 from members of the Society.

Donations were received as follows: From James A. Henshall, M.D., 75 species of Ohio fishes, represented by numerous specimens, collected and prepared for exhibition by the donor. From U. S. Fish Commission, through Capt. J. W. Collins, specimens of fishes, mackerel food, foraminifera, and salmon eggs and fry; from G. D. Gifford, New Bedford, Mass., specimen of spider crab; from Florence Ware, City, specimen Conus tessellatus.

Adjourned.

SPECIAL MEETING, *November* 11, 1888.

President Skinner in the chair.

This meeting was for the hearing of the paper on "Guns, and the Measurement of the Velocity of Projectiles," by Col. J. W. Abert, postponed from the regular November meeting. The paper, by the request of Col. Abert, was read by President Skinner.

Capt. A. H. Russell, U. S. A., in charge of the Army Department of the Government Exhibit at the Centennial Exposition, then gave a practical demonstration of the measurement of the velocity of a bullet, by means of the Boullenge Chronograph; and explained the operation of the pendulum chronograph.

The lecture-room of the Society was well filled by an appreciative audience.

Adjourned.

SCIENTIFIC MEETING, *December* 4, 1888.

President Skinner in the chair.

The lecture-room of the Society was well filled.

Minutes of the November Scientific and the special meetings were read and approved.

Capt. A. H. Russell, U. S. A., gave a very interesting practical lecture on "How Bullets Fly Through the Air," explaining the mechanics and science of projectiles by the use of a number of ingenious contrivances and apparatus.

Dr. A. J. Howe read a paper entitled "The Riverside Skull;" being a few remarks in relation to the skull recently found at Riverside, and an extended dissertation on crania.

Col. J. W. Abert then supplemented Capt. Russell's remarks by giving a few striking and familiar examples of the principles of the flight of an elongated bullet from a rifled gun.

Mr. Davis L. James read by title two papers, one on "The Distribution of *Vernonia*," by Prof. Jos. F. James, and the other a "Monograph of the *Phalloidea*," by A. P. Morgan.

Upon motion a vote of thanks was extended to Capt. Russell and Dr. Howe for their able and pleasing efforts.

President Skinner gave an interesting account of a new plan or process for the reduction of refractory gold and silver ores, the discovery of Mr. Wm. Norris Davis, of Philadelphia.

Mr. Davis L. James reported progress on behalf of the Lecture Committee, and stated that the programme of lectures would soon be announced; that most of the lecturers had been secured; and that Greenwood Hall, by the courtesy of the Ohio Mechanics Institute, had been obtained for these lectures.

Dr. B. M. Ricketts suggested that a committee be appointed to endeavor to secure a suitable lot in Eden Park, with a view to the erection, at some future time, of a building for the Society.

Upon motion Dr. Ricketts was appointed a committee to present names for such a committee at the next meeting of the Society.

The following names were proposed for active membership: John E. Bell, Alfred Warren and Dr. J. S. Newberg.

The following gentlemen were elected to active membership: J. M. Newton, Dr. Ralph S. Michel, Dr. B. F. Beebe, and Dr. Edwin Ricketts.

It being suggested that as the January meeting would occur on New Year's night, it would be desirable to postpone it, it was upon motion resolved that the January meeting be held on the second Tuesday of the month.

Upon motion of Prof. Harper the resignation of Rev. Raphael Benjamin, as a member of the Society, be accepted with regret, and that this feeling of the Society be communicated to Mr. Benjamin by the Secretary.

President Skinner gave notice that at the next regular meeting of the Society a member of the Executive Board would be elected in place of Mr. Benjamin, removed to New York.

Donations were received as follows: From Robt. Clarke, Esq., City, casts of Cincinnati and Waverly tablets; from California State Mining Bureau, through W. T. Garratt, Esq., large collection of minerals, woods, fossils, casts, etc.; from Dr. Kusnick, Riverside, prehistoric skull (human), portion of mastodon tusk; from Dr. Tarleton H. Bean, of U. S. Fish Commission, specimen of White-winged Scoter; from Mr. Powell, of Powell & Clement, specimen of truffle(?).

Adjourned.

REPORT ON THE MUSEUM.

BY H. P. SMITH, CUSTODIAN.

CINCINNATI SOCIETY OF NATURAL HISTORY—*Dec.* 15, 1888.

In conformity with instructions to that effect from the Executive Board of the Society, I have the honor to report as follows upon the extent of the collections of the Society in the several departments, also upon the library and the exchange of publications.

I. PALÆONTOLOGY.

I.	The Trenton and Hudson River Groups are represented in the Society's collection by . . .	70	species.
II.	The Cincinnati Group " . . .	317	"
III.	" Clinton " " . . .	16	"
IV.	" Niagara " " . . .	120	"
V.	" Medina and Helderberg Group, by .	100	"
VI.	" Corniferous " " .	100	"
VII.	" Carboniferous " " .	225	"
VIII.	" Sub-Carboniferous " " .	200	"
IX.	" Cretaceous " " .	75	"
X.	" Triassic " " .	5	"
XI.	" Tertiary " " .	175	"
XII.	" Quaternary " " .	32	"
XIII.	" European Formations " " .	130	"
	Total	1,619	"

Of this number more than 600 species are stored in drawers.

CINCINNATI GROUP IN DETAIL.

The number of genera and species given is based upon the "Catalogue of the Fossils of the Cincinnati Group," by Prof. Jos. F. James.

The first line of numbers under "Genera" and "Species," indicates the number of genera or species in the Catalogue and the second line the number in the collection of the Society.

Class.	*Genera.*	*Species.*
Plantæ . .	21—17 . .	37—27
Spongida . .	12— 1 . . .	29— 5

Class.	*Genera.*	*Species.*
Polypi	26—14	132—86
Crinoidea	6— 4	42—16
Cystoidea	6— 4	19—11
Asteroidea	3— 1	17— 2
Ophiuroidea	2— 1	3— 1
Polyzoa	9— 6	63—34
Brachiopoda	15—13	117—71
Gasteropoda	15—12	65—25
Pteropoda	2— 1	4— 2
Cephalopoda	8— 4	40—19
Lamellibranchs	18—12	89—33
Annelida	12— 8	33—11
Crustacea	13—10	54—20
Pisces(?)	2— 0	3— 0
Incertas edes	10— 5	19— 8
Totals,	180—113	768—371

REMARKS ON DEPARTMENT OF PALÆONTOLOGY.

Though the collection may not be called large it is in excellent condition and contains many rare and very valuable specimens.

The horn cores of *Bison latifrons*, and the cranium of *Bootherium Cavifrons*, which are in almost perfect state of preservation, are of great value and would be the pride of any museum in the world.

The gaps which exist in the local collection, may, I believe, be filled by members and friends of the Society, if they be informed of what is lacking, and solicited, on behalf of the Society, to fill such of these wants as they may feel able to do.

This department should above all others be complete in its local collection. In this city, situated in what is known in this country and Europe as the classical ground of the Lower Silurian, there certainly should be a complete collection of its fossils, and under every consideration this Society should possess it.

II. BOTANY.

There are in the herbarium of this Society about 3,500 species of plants represented. This number does not include the Morgan Collection of Fungi, of which mention will be made later. The flora of California and Mexico is well represented; largely in collections from these localities purchased from C. G. Pringle.

The local flora, exclusive of Fungi, as catalogued by Prof. Jos. F. James, includes approximately 899 species.

There are in the herbarium of the Society 745 species, collected in this immediate vicinity or in Ohio, which latter may be counted as belonging to our local flora. This number does not include specimens from Indiana and Kentucky, many of which are also found in the vicinity of Cincinnati.

The collection of Fungi includes a large number of species from Hamilton County. Almost the entire collection is from the herbariums of Mr. A. P. Morgan and Prof. Jos. F. James.

III. CONCHOLOGY.

There are in the collection of this Society more than 3,200 species of shells, named and localized.

No complete catalogue of the shells of this locality has been prepared, so it is impossible to give with exactness the local value of the collection.

The Society possesses a fine collection of Unionidæ from this vicinity, and a good collection of the Helicidæ, so without definite numbers, it may be said that the local collection of shells is probably as good as in any other department of the Museum.

IV. ICTHYOLOGY.

The department of Icthyology contains at this time 264 species of fish.

Of these, 150 are marine, received from the U. S. Fish Commission. Of the fishes of this locality, the Society has, up to this time, had but four representatives.

During the past summer Dr. Henshall has collected fishes of the Ohio and tributaries for the Society, in number, about 110 species, so the collection now possesses nearly two-thirds of the fishes of the State. These fishes have been identified, labeled and placed in the collection by the individual work of Dr. Henshall.

V. HERPETOLOGY.

This department contains 28 species and 32 specimens.

It is very incomplete in the local reptilian fauna.

VI. ORNITHOLOGY.

The department of Ornithology contains a few very fine exotics, and is well supplied with local species.

The list of Dr. F. W. Langdon gives 279 species of birds found in Cincinnati and vicinity. Of these the Society has, of mounted specimens, 133 species, of skins 90 species, a total of 223 species. Among the skins should be mentioned that of the Cincinnati Warbler, taken and named by Dr. Langdon; the only specimen ever taken. The local collection is being filled as rapidly as possible. The collection needs more room and better light to display it properly and give it its true value.

VII. MAMMALOLOGY.

The Society possesses an excellent and very valuable collection of mammalian fauna, though it is not a representative local collection, having very few of the mammals of this vicinity.

The several classes of mammalia are represented as follows:

Primates, .	24	Species,	37	Specimens.
Carnivora, .	22	"	42	"
Pinnipedia, .	2	"	2	"
Ungulata, .	6	"	6	"
Cheiroptera, .	2	"	5	"
Insectivora,	2	"	2	"
Rodentia, .	14	"	15	"
Edentata, .	1	"	1	"
Marsupialia, .	6	"	9	"
Totals,	79	"	119	"

VIII. ENTOMOLOGY.

A large proportion of the specimens in the department of Entomology are found in this locality, but it is far from being complete in this respect.

There are more than 450 species of Coleoptera in the collection.

Of Lepidoptera there are not so many species represented; though I am unable at present to state the exact number—200 species would be somewhat less than the actual number.

The other classes are represented by a small number of specimens.

The collection needs more commodious and convenient quarters than it is possible for it to have at present.

IX. OSTEOLOGY.

The Society possesses a number of very good skeletons, one, that of the giraffe, being quite a rare one.

The finest skeleton possessed by the Society, that of the elephant, can not be set up for want of room, and in consequence has to be stored in the basement.

The collection contains, besides the two mentioned above, fair skeletons of the camel, moose, deer, kangaroo, wombat. lion, alligator and several more common animals, and a few birds and reptiles. There is an abundance of material in this department to make a very creditable exhibit.

X. ETHNOLOGY.

In this department the Society has a series of casts of skulls representing types of different nationalities, and several recent skulls of Indians; together with implements of war and domestic use, from the Indians, Swiss Lake Dwellers, Cliff Dwellers, etc.

The archæological collection is very valuable; containing a large number of skulls and relics from the pre-historic cemetery at Madisonville, Ohio, a collection which it would be impossible to duplicate. A collection of pottery from Missouri, of considerable value, and specimens lately received from the National Museum and the California State Mining Bureau, complete the report of this department.

It will be seen that local archæology is well represented here, in the Madisonville collection, but this is a small part of the rich harvest which this part of the country has afforded—too much of which has been compelled to go, or permitted to go, to Eastern museums for a home.

XI. MINERALOGY.

The collection of minerals contains about 1,200 specimens, and is in excellent condition as to identification and locality.

A collection of about 80 specimens, received from the California State Mining Bureau, has recently been added.

THE LIBRARY.

The library of the Society now includes about 4,500 books and pamphlets, and its increase is steady and rapid.

Its principal source of increase is the exchange of the JOURNAL for the publications of scientific societies, and for scientific periodicals in all parts of the world.

The accompanying list of these exchanges will show the extent and great value of this work.

In no other department is the want of sufficient room so much felt as in this.

New and valuable exchanges are frequently added to the list: among those of the present year are the Bristol Naturalists' Society of England, and the Survey of India Department.

List of exchanges received for the JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

I. UNITED STATES.

Albany:
- Albany Institute.
- New York Agricultural Exp. Station.
- New York State Museum.

Amherst:
- Amherst College.

Baltimore:
- Johns Hopkins University.

Boston:
- American Academy of Arts and Sciences.
- Boston Society of Natural History.

Brooklyn:
- Entomological Society.

Brookville, Ind.:
- Natural History Society.
- Amos W. Butler.

Buffalo:
- Society of Microscopists.
- Society of Natural History.

Cambridge:
- Museum of Comparative Zoology.
- Peabody Museum of Archæology and Ethnology.
- Psyche.

Chapel Hill, N. C.:
- Elisha Mitchell Scientific Society.

Chicago:
- Academy of Sciences.

Cincinnati:
- Ohio Historical and Philosophical Society.
- Cincinnati Observatory.
- Public Library.

Columbia, Mo.:
  University of Missouri.
Champaign, Ill.:
  Illinois State Laboratory of Natural History.
Columbus:
  State Meteorological Bureau.
  Horticultural Society.
Crawfordsville, Ind.:
  Botanical Gazette.
Davenport, Iowa:
  Academy of Natural Sciences.
Denver:
  Colorado Scientific Society.
Des Moines:
  Academy of Sciences.
Frankfort:
  Kentucky Geological Survey.
Manhattan, Kan.:
  Journal of Mycology.
Mendon, Ill.:
  American Antiquarian.
Milwaukee:
  Public Museum.
Minneapolis:
  Minnesota Academy of Sciences.
  State Geologist.
Newport, R. I.:
  Natural History Society.
New Haven:
  American Journal of Science.
  Connecticut Academy of Arts and Sciences.
New Orleans:
  Academy of Sciences.
New York:
  American Museum of Natural History.
  American Geographical Society.
  American Garden.
  The Auk.
  Linnean Society.
  New York Academy of Sciences.

New York Microscopical Society.
School of Mines Quarterly.
Torrey Botanical Club.

Philadelphia:

American Naturalist.
American Philosophical Society.
Franklin Institute.
Philadelphia Academy of Natural Sciences.
Philadelphia Zoological Society.
Second Geological Survey of Pennsylvania.
Wagner Free Institute.

Poughkeepsie:

Vasser Brothers Institute.

Princeton:

Princeton College.

Salem:

Essex Institute.
American Association for the Advancement of Science.

San Francisco:

California Academy of Science.
California State Mining Bureau.
Technical Society of the Pacific Coast.

Sedalia, Mo.:

Natural History Society.

St. Louis:

Academy of Natural Sciences.

Topeka:

Kansas Historical Society.
Washburn College Laboratory of Natural History.

Trenton, N. J.:

Natural History Society.

Washington:

American Monthly Microscopical Journal.
Bureau of Education.
Entomological Society.
Philosophical Society.
Smithsonian Institution.
U. S. Geological Survey.
U. S. National Museum.

U. S. Department of Agriculture.

U. S. Commission of Fish and Fisheries.

Number of Exchanges in the United States, 74.

II. FOREIGN.

Argentine Republic:

Cordoba: Academia Nacional de Ciencias.

Austria:

Vienna: K. K. Naturhistorischen Hofmuseum.
Kaiser Konig Geologischen Reichsanstalt.

Gorz: Baron von Thumen.

Australia:

Sidney: Linnean Society.
Department of Mines, N. S. Wales.
Royal Society of New South Wales.

Melbourne: Public Library, Museum and National Gallery of Victoria.

Belgium:

Brussels: Societe Malacologique de Belgique.

Brazil:

Rio Janeiro: Museu Nacional.

Canada:

London: Canadian Entomologist.

Montreal: Canadian Record of Science.

Toronto: Canadian Institute.

Ottawa: Geological and Natural History Survey of Canada.
Field Naturalists' Club.

Winnipeg: Manitoba Historical and Scientific Society.

Chili:

Santiago: Wissenschaftlichen Verein.

Costa Rica:

San Jose: Museu Nacional.

England:

Bristol: Naturalists' Society.

London: Royal Microscopical Society.

Manchester: Philosophical Society.

France:

Toulouse: Academie des Sciences, Inscriptions et Belles Lettres.

Germany:

Augsburg: Naturhistorischen Verein.

Berlin: Akademie die Wissenschaft.
Botanischen Verein der Prov. Brandenburg.
Basel: Naturforschenden Gesellschaft.
Bremen: Naturwissenschftlichen Verein.
Braunschweig: Verein fur Naturwissenschaft.
Cassel: Verein fur Naturkunde.
Frankfort on Oder: Societatum Litterae.
Giesen: Oberhessiche Gesellschaft fur Natur und Heilkunde.
Halle: K. Leopold-Carolin Deutschen Akademie der Naturforschen.
Leipsic: Verein fur Erdkunde.
Munster: Westfalichen Provinzial Verein fur Wissenschaft und Kunst.
Stuttgart: Verein fur Vaterlandische Naturkunde in Wurttemberg.

Holland:
Leiden: Netherland Zoological Society.

India:
Calcutta: Geological Survey of India.
Survey of India Department.

Italy:
Naples: Societe Africana d Italia.
Pisa: Societa Toscana di Scienza Naturali.
Rome: Ministero di Agricoltura Industria E Commercio.
Turin: Musei di Zoologia ed Anatomia Comparata.

Japan:
Tokyo: Deutschen Gesellschaft fur Natur und Volkerkunde Ostasiens, Teikoku Daigakee.

Mexico:
Mexico: Sociedad Mexicana de Historia Natural.
Sociedad Cientifica, "Antonio Alzate."

Norway:
Christiania: Royal University of Norway.

Nova Scotia:
Halifax: Nova Scotian Institute of Natural Sciences.

Russia:
Kiew: Societe des Naturalistes.
Moscow: Societe Imperiale des Naturalistes.
St. Petersburg: Comite Geologique de Russie.

Scotland :

Edinburgh : Botanical Society.
Royal Society.
Royal Physical Society.
Glasgow : Natural History Society.

South Africa :

Cape Town : Philosophical Society.

Spain :

Barcelona : Academia de Ciencias Naturales y Artes.

Sweden :

Stockholm : l'Academie Royale des Sciences.
Kong'l vetenkaps Akademiens.
L'Institute Royal Geologique de la Suede.
Riksmusei Palaentologiska.

Switzerland :

Bern : Naturforschende Gesellschaft.
Zurich : Schweirzerischen Naturforschende Gesellschaft.

Total Foreign Exchanges, ...	64
Domestic Exchanges, ...	74
Grand Total, ...	138

Respectfully submitted,

HORACE P. SMITH, Custodian.

CONTRIBUTIONS TO THE ICHTHYOLOGY OF OHIO.

No. 2.

By Dr. James A. Henshall.

In the Journal of the Society for July-October, 1888, pp. 76-80 I have recorded a list of seventy species of fourteen families of fishes collected within the limits of Hamilton County, in April and May, 1888. Since that time, in July, I visited Sandusky and Put-in-Bay, where I was enabled to identify a number of species belonging to the fauna of Lake Erie.

In August, Hon. Nicholas Longworth of this city, in the cause of science, kindly placed at my service his fine and commodious steam-yacht "C. O.," with full crew of six men, for the purpose of an exploration of the Ohio River and its tributaries. Owing to this characteristic act of liberality and generosity on the part of Judge Longworth, Prof. C. H. Gilbert and myself were enabled to spend three weeks on the Ohio and its tributaries, between Marietta and Cincinnati; and although the river was at an unprecedented high stage of water for the season—from twenty to thirty feet above low water-mark—covering the bars and backing up the tributaries for miles, we succeeded in collecting most of the species named in my former list, in extending the range of other species, and in adding some not named in that list, and others not heretofore taken in Ohio waters.

During September and October I assisted Capt. J. W. Collins and Dr. T. H. Bean, of the U. S. Fish Commission, in collecting fishes from Ross Lake, Little Miami River and Sycamore Creek, for stocking the aquaria of the Commission on exhibit at the Ohio Valley Centennial Exposition, and I also had opportunities of examining the aquaria of Mr. Hugo Mulertt at the same Exposition. I have also occasionally inspected the fish markets of Cincinnati for species from the Ohio River and Lake Erie.

From these various sources I have been enabled to add forty species and ten families of Ohio fishes not named in my first list—a few of which are also to be added to the fauna of Hamilton County.

My former list and the present one aggregate one hunderd and ten species, distributed among twenty-four families, which I think is fully two-thirds of the entire number of known species to be found in Ohio waters. Next summer I hope to add to these lists by exploring the streams in the interior of the State, on both sides of the water-shed separating the waters of Lake Erie from those of the Ohio Valley.

A number of fishes which I know to be common to Lake Erie, and some that belong to the Ohio River system, are not included in these lists, and will not be until I have positively identified them as existing within the limits of the State.

I am arranging a series of species from these collections for the Museum of the Society, and shall add to it from time to time as opportunity offers; for I deem it of the utmost importance that the Society should possess as complete an exhibition of the fishes of Ohio waters as possible. Heretofore this branch of the fauna of the State of Ohio has been entirely ignored or neglected, for I find, outside of my own collections, but four specimens of Ohio fishes in the Museum of the Society—a sturgeon, a paddle-fish, a gar and an eel.

In the following list the name of the original describer of each species is alone given, as in the first list. Where the original combination of generic and specific title is still retained, the name of the author is printed without parentheses; where, however, the original describer places the species in question in a genus different from the one here adopted, the author's name is inclosed in parentheses—following the plan adopted by Dr. D. S. Jordan in his last edition of "Manual of the Vertebrates."

Those families marked with an (*) asterisk are additional to the first list.

Family I.—PETROMYZONTIDÆ. *

1. PETROMYZON CONCOLOR (Kirtland). Lamprey. A specimen of this species, about six inches long, was presented by Dr. Chas. E Caldwell, it having passed through a hydrant pipe in a house in the city.

Family II.—LEPISOSTEIDÆ. *

2. LEPISOSTEUS OSSEUS (Linnæus). Long-nosed Gar. Ohio River; Lake Erie.

3. LEPISOSTEUS PLATYSTOMUS Rafinesque. Short-nosed Gar. Lake Erie.

Family III.—AMIIDÆ. *

4. AMIA CALVA Linnæus. Dog-fish. Lake Erie.

Family IV.—SILURIDÆ.

5. AMEIURUS NATALIS (LeSueur). Yellow Cat. Lake Erie.

6. AMEIURUS VULGARIS (Thompson). Long-jawed Cat. Lake Erie.

7. AMEIURUS NEBULOSUS (LeSueur). Bull-head. Lake Erie.

8. LEPTOPS OLIVARIS (Rafinesque). Mud Cat. White Oak Creek; Ohio River.

9. NOTURUS MIURUS Jordan. Variegated Stone Cat. Ohio River (Raccoon Island).

10. NOTURUS GYRINUS (Mitchill). Chubby Stone Cat. Ross Lake.

Family V.—CATOSTOMIDÆ.

11. ICTIOBUS URUS (Agassiz). Razor-backed Buffalo. Ohio River (Cincinnati).

12. ICTIOBUS THOMPSONI (Agassiz). Lake Carp. Lake Erie.

13. CATOSTOMUS CATOSTOMUS (Forster). Northern Sucker. Lake Erie.

14. MOXOSTOMA AUREOLUM (LeSueur). Lake Red-horse. Lake Erie.

The species in first list called MOXOSTOMA CRASSILABRE has since proved to be PLACOPHARYNX CARINATUS, which we found to be abundant in the Ohio and its tributaries. I do not think the former species exists west of the mountains.

Family VI.—CYPRINIDÆ.

15. HYBOGNATHUS NUCHALIS Agassiz. Silvery Minnow. White Oak Creek; Ohio River.

16. HYBOPSIS HYOSTOMUS (Gilbert). Hog-mouthed Chub. Ohio River (Raccoon Island).

17. CYPRINUS CARPIO Linnæus. German Carp. I saw two fine Mirror Carp taken on a trot-line, with helgramite (larva of CORYDALIS CORNUTUS) bait, at Remington, L. Miami River; Ross Lake.

Family VII.—SALMONIDÆ *

18. COREGONUS CLUPEIFORMIS (Mitchill). White-fish. Lake Erie.

19. COREGONUS ARTEDI LeSueur. Lake Herring. Lake Erie.

20. SALVELINUS NAMAYCUSH (Walbaum). Lake Trout. Lake Erie.

21. SALVELINUS FONTINALIS (Mitchill). Brook Trout. Castalia Creek (near Sandusky). This is a very cold spring creek proceeding from the well-known Castalia spring, and is, I believe, the only trout stream in Ohio; the stock is kept up by the introduction of fry at regular periods.

Family VIII.—ESOCIDÆ *

22. ESOX VERMICULATUS LeSueur. Grass Pickerel. Maumee River; Lake Erie.

23. ESOX LUCIUS Linnæus. Northern Pickerel; Pike. Lake Erie; Sandusky River.

24. ESOX NOBILIOR Thompson. Mascalonge. Ohio River; Lake Erie. I have seen heads of large pike from several streams in eastern Ohio and North-western Kentucky, said to have weighed from thirty to forty pounds, and there were no specific differences between them and those of the mascalonge of the Great Lakes.

Family IX.—ANGUILLIDÆ *

25 ANGUILLA ANGUILLA (Linnæus). Eel. Lake Erie; Ohio River.

Family X.—GASTEROSTEIDÆ. *

26. EUCALIA INCONSTANS (Kirtland). Brook Stickleback. Castalia Creek.

Family XI.—APHREDODERIDÆ. *

27. APHREDODERUS SAYANUS (Gilliams). Pirate Perch. Lake Erie.

Family XII.—CENTRARCHIDÆ.

28. POMOXIS ANNULARIS Rafinesque. New-light; Croppie. Muskingum River; Ohio River (Raccoon Island).

29. AMBLOPLITES RUPESTRIS (Rafinesque). Rock Bass. Lake Erie; Ohio River (near L. Sandy R.).

30. LEPOMIS NOTATUS (Agassiz). Sun-fish. L. Miami River.

31. LEPOMIS GIBBOSUS (Linnæus). Common Sun-fish. Ross Lake; Lake Erie.

Family XIII.—PERCIDÆ.

32. ETHEOSTOMA ASPRELLUS (Jordan). Rough Darter. Muskingum River.

33. Etheostoma copelandi (Jordan). Copeland's Darter. Muskingum River; Ohio River (Raccoon Island).

34. Etheostoma shumardi (Girard). Shumard's Darter. Muskingum R.; Ohio R. (near Parkersburg).

35. Etheostoma scierum (Swain). Shaded Darter. Ohio River (near L. Sandy R.).

36. Etheostoma evides (Jordan and Copeland). Gilded Darter. Ohio R. (Raccoon Island).

37. Etheostoma camurum (Cope). Blue-breasted Darter. Muskingum River.

38. Perca flavescens (Mitchill). Yellow Perch. Lake Erie; St. Mary's Reservoir.

Family XIV.—SERRANIDÆ, *

39. Roccus chrysops (Rafinesque). White Bass. Lake Erie.

Family XV.—GADIDÆ *

40. Lota lota (Linnæus). Lake Erie.

BIG GUNS.

By Col. J. W. Abert.

(Read November. 1888.)

The advances in artillery since our late war have placed gunnery among the most refined mechanical sciences of the age.

In 1842 experiments were made by Col. Bomford U. S. A., which showed the diminishing pressure of a charge of powder from the breech to the muzzle of a cannon. These experiments controlled the external form of the gun. And the tensile strength of a square inch bar, of the metal of which the gun was composed, showed its strength, and limited the quantity of powder in the charge.

When we consider that 200 pounds to the square inch is the limit of the test of our steamboat boilers, and that some of our steel guns are made of metal which possessed a tensile strength of 33 tons to the square inch, we can appreciate the stupendious power of the machines which the progress in the art of war has placed in our hands in the rifled cannon of the present times.

It is an axiom in artillery that no gun can sustain a pressure per square inch greater than the tensile strength of a square inch bar of metal of which it is composed.

The amount of pressure exercised by the firing of the charge of powder can be shown for every part of the gun, from breech to muzzle—

First, by Bomford and Wade's experiments.

Second, by Rodman's pressure guage.

Third, by the Electro-ballistic Chronoscope. —

To Prof. Joseph Henry, of the Smithsonion Institution, and formerly my old Professor at Princeton College, N. J., belongs the credit of using the electric spark in recording the velocity of projectiles, and solving the most difficult of problems in gunnery. Thus, we obtain the initial velocity; also the velocity of the projectiles at any point of the trajectory.

Prof. Henry devised the first complete Electro-ballistic Chronoscope, for recording by electrical agency the time occupied by a projectile in its passage between two given points. Henry's chronograph provides against every instrumental error. Terminal pairs of wires from a number of different pairs of screens, through which the projectile passed, would send sparks which perforated the graduated paper covering the recording cylinder, and impressed their marks; thus, the velocity of the projectile, in all required points in its path, may be determined by a single experiment. He visited Maj. Mordecai during his ballistic experiments at the Washington Arsenal and told him that velocities could be best determined by electricity.

Capt. Schultz of the French army combined a method of graphically recording vibrations of a tuning-fork with Helmholtz's way of making them isochronous and Henry's cylinder and induction spark, and produced an apparatus capable of meeting every demand required in the solutions of questions in regard to this subject —

Proof of gunpowder,
Hygrometrical test,
Proportion of ingredients,
Mode of manufacture,
Density,
Size of grains,
Charges for guns,
Cartridges for cannon,
Windings of balls,
Loss of force by the vent,
Effects of wads, etc.

In a X inch gun, 100 inches in length, the total time required for the projectile to reach the muzzle is $\frac{1}{100}$ of a second. Records are obtained from the chronoscope of the time required for the passage of the shot, between two points in the gun only 2.7 inches apart.

If you desire to estimate the strain on the gun, or the quantity of motion imparted to a projectile, we know that if the mean pressure (P) of the gas be multiplied by the space (S) passed over by the projectile in acquiring its velocity, the result will be the measure of the work done by the charge of powder; and it will be equal to the work of stopping the same projectile, no matter how or by what means it may be done.

The same result is obtained by measuring the velocity imparted to the projectile under the circumstances mentioned, and multiplying the square of the velocity by one-half the mass of the projectile, since the mass is equal to the weight divided by the force of gravity.

"The expression of the work stored in the projectile, and which must be expended in bringing it to rest $= \frac{W v^2}{2 g}$ where W. = weight of the projectile, V. = velocity of the projectile in feet, and g = the force of gravity in feet, or the velocity a body will acquire by its own weight in one second of time."

The machines for ascertaining pressure are: The ballistic pendulum, Navez's Chronoscope, Benton's thread velocimeter, Boulenges' Chronograph, Schultz's Chronoscope, Rodman's pressure guage, Noble's Chronoscope and Vignotti, Cushing and others. Through the kindness of Capt. A. H. Russell, U. S. ordinance corps, we have the opportunity of examining the chronoscopes which were displayed at the War Department Exhibit at the Cincinnati Exposition. Capt. Russell will demonstrate the practical working of these machines.

The purpose of these machines is to measure the velocity of a bullet or a cannon ball, while passing over the space between two targets.

Whether we use pendulums, or heavy rods, as in the Boulange machines, the general principles are the same. I have made a drawing on the blackboard of the Boulange machine, as it seemed to me to be the simplest to understand.

This instrument consists of a central standard or supporting rod which carries two electro-magnets. The magnet highest upon the Standard is connected by electric wires to target No. 1, and it supports a heavy rod of 20 inches in length, which rod drops the instant that target No. 1 is attained by the projectile. When target No. 2 is ruptured the magnetic current to the second magnet is cut, and instantly the second rod falls. In falling it strikes the disk at the end of a lever, which sets free a circular knife. This knife makes a cut on the first rod, which thus records how far the first rod had fallen before the second rod was set free.

Before beginning to experiment, you set free the short rod only, and the cut or nick made by the knife when the long or chronometer rod is at rest, will give the "origin" or zero point from which you measure the height fallen by the chronometer rod, while the projectile is traversing the distance between the targets.

Since the fall of the chronometer rod follows the law of fall of heavy bodies, we have the formula $T'=\sqrt{\frac{2H}{g}}$. which is the equation of this machine. Now T′ represents the time which the chronometer rod occupies in falling (the distance H), supposing every part of the machine to act instantaneously, but there is a delay in the action of the first magnet, which would shorten the value of the time, we therefore designate it by $-M$.

There is a delay in the action of the second magnet, which upholds the short or "register rod," designate this by $+M'$; a delay due to the time required by the short rod to fall on the trigger, call this $+t'$; next we have a delay caused by the time required for the disengagement of the trigger, equal to $+t''$; and lastly a a delay required for the knife to reach the chronometer rod, call this correction $+t'''$, consequently we must correct the value of T′ by subtracting the sum of these quantities. Designating the true time by T, we now find that $T=T'-(M'+t'+t''+t'''-M)$ or calling the sum of the corrections t we have $T=T'-t$.

The value of (t) the sum of the corrections can be obtained by means of the device called the "Disjunctor;" it serves to break the electric currents from both targets at the same instant, and the nick made by the knife on the chronometer rod will mark a point called the "disjunctor reading." Commencing with this point as the origin, or O point, we get the corrected value $T'-t$, that is the true value T.

A graduated rule, or scale, is used for measuring the height of the nick above the zero point. If you have the scale calculated for a distance of fifty yards, the velocity of the projectile can be at once determined. Should it be necessary to place the targets nearer, the velocity can be found by multiplying the number read off the scale by the actual distance between the targets divided by fifty. The height of the nick on the chronometer rod above the "origin" is given by the formula $H=\frac{1}{2}g\,T'^2$.

In the chronoscopes which have pendulums in place of the rods, the time due to the arc of oscillation can by the theory of the pendulum be readily ascertained.

Benton's chronoscope recommends itself on account of its great simplicity, as it dispenses with the necessity of voltaic batteries. It operates by the means of threads which are stretched from the targets to the pendulums, the threads in being ruptured by the projectile, on traversing targets 1 and 2, instantly let fall the pendulums corresponding to these targets.

The Noble chronoscope registers the precise instant when a projectile passes certain points in the bore of the gun. The recording apparatus consists of disks 36 inches in circumference, which are made to revolve at the speed of 1,000 inches per second, linear velocity: by means of a vernier each inch is divided into $\frac{1}{1000}$, a linear representation is thus obtained at the circumference, of the one millionth part of a second ($\frac{1}{1000000}$ of a second).

Plugs of steel containing the wires of the induction coil, are screwed into the gun, with a device at the end of the plug. so that as each plug is reached by the projectile, the wires are cut and the spark is delivered.

Records have been obtained of plugs only 2.4 inches apart.

From the velocities of the projectile thus obtained we can determine exactly the amount of pressure on each square inch of the bore, due to the firing of the charge of powder, and the velocity at any point of the trajectory.

The total energy of a body in motion is the whole amount of work it will produce before being brought to a state of rest, it varies as the weight of the body multiplied by the square of the velocity. This work is equal to the weight it is capable of raising one foot high, and is equal to the weight in pounds of a projectile, multiplied by the square of the velocity in feet and divided by twice the accelerating force of gravity.

Thus, if a projectile of 165 pounds, be moving with a velocity of 1,470 feet per second, the work it will accomplish is

$$\frac{165 \times (1470)^2}{64.4.} = 2472 \text{ foot tons.}$$

The energy in the 2,000 pound projectile fired from the 100 ton gun at Spezia was over 30,000 foot-tons. That is to say, that if the Italian armor-clad vessel, the "Duilio" weighed 10,000 tons, the energy stored in the projectile of one of her own guns would lift the whole ship bodily to the height of three feet.

If the projectile should strike the turret of a monitor, which turret weighed 400 tons or so, the gearing would be so strained that the turret could not work ; or when we consider there is sufficient energy to lift it as high as the main-top, it requires no great stretch of the imagination to understand that such a turret, with all its contents might be knocked clean overboard.

The penetrating effect of a projectile is equal to the energy per inch of circumference in foot-tons, *i.e.*, the total energy divided by the number of inches in the circumference of the projectile—

$$P = \frac{Wv^2}{2g \times 2\pi R^2}$$

The energy of the projectile is met by the resistance required to shear a hole in the armor, which will coincide with the circumference of the projectile.

In 1865 our largest guns were smooth-bore, muzzle-loaders, 20 feet 3 inches long, 20 inches caliber, and weighed 51 tons.

Then came the long, tapering steel guns, built up of numerous coils of steel, with breech plugs or "obturators," which are hinged to the breech of the gun, or are arranged to rest on a sliding table, to be moved by steam.

The dimensions of the steel guns are as follows:

23	feet	4	inches	long,	8 inch	caliber,	13 tons	weight.
28	"	5	"	"	10	"	27 "	"
34	"	1	"	"	12	"	47 "	"
45	"	5	"	"	16	"	115 "	"
60	"	0	"	"	17¾	"	150 "	"

Dimensions, etc., of the 110 ton ("Armstrong Gun") English gun, breech-loader: Caliber, 16.25 in.; length, 43 feet; length of bore, 30 feet; weight of gun charge, 900 pounds powder; weight of projectile, 2,240 pounds; length of projectile, 4½ feet; range, 10 miles, at high elevation, 13 miles; muzzle velocity, 2,128 feet per second; energy, 56,520 foot-tons; penetration, 33.8 inches in wrought iron, will withstand a pressure of 30 tons to the square inch.

The big German gun, of Krupp, weighs 150 tons; the projectile, 3,300 pounds; the length is 60 feet; charge of powder, ½ ton range, 10½ miles.*

At the Centennial Exposition is a wooden model of the shell of the Krupp gun, which is 6 feet high and 1½ feet in diameter, or 4½ feet circumference.

Instead of the old-fashioned 12 inch and 13 inch mortars, we now have a long 12 inch howitzer, firing a bomb-shell, and with seventy pounds of powder it has a range of six miles. Fired at an angle of 75° the shell can be thrown to the height of three miles.

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*Length of charge, 6 feet 4 inches, second half with a cylindrical space or fine grained powder; length of shell, 4 feet 7 inches; weight of charge, ,800 pounds; charge of shell, 200 pounds.

We have "disappearing carriages," by means of which the gun can be dropped down out of sight, and out of horizontal fire of the enemy—Major King's counterpoise carriage for muzzle loaders, and the Elswick hydro-pneumatic carriage for breech-loaders. They are protected with armor-plated shields or turrets.

We have the Gruson armored battery, with embrasures of chilled iron, a model of which is to be seen at the Exposition building in Cincinnati.

To operate the very big guns, we require complicated carriages, on which the gun is mounted with hydraulic jacks for lifting, pneumatic cylinders for checking recoil, and various levers for moving the gun by hand, for opening and closing the breech, hoisting and inserting the charge - machines which require for their manipulation and repair a skilled mechanical engineer.

Other nations have these war appliances, and we are compelled to keep pace with them or be at their mercy in time of war.

The multiplicity of devices displayed in the War Department Exhibit of the Centennial Exposition, demonstrates the necessity of complete records, and of life study on the part of a certain set of officers, whose attention is constantly directed to these subjects.

The big guns of our late war were not of long life. One thousand rounds is considered the average life of such guns, but the Rifled Parrott Guns—100, 200 and 300 pounders—which we used at the bombardment of Charleston, S. C., many of them endured not more than 100 rounds. The first 200 pound gun placed in the Swamp Angel Battery, burst on the thirty-sixth round.

On the south end of Morris Island 24 bursted guns lay in fragments, and one a disabled Witworth gun. With many the butt-end of the breech was blown out of the wrought-iron jacket or reinforce. In others the body of the gun, owing to a transverse strain, was split into fragments along the lines of the axis of the bore. The grooves much eroded and the lands worn flat. These guns are quite expensive machines, for the new steel guns of Krupp cost about $1,000 per ton.

The fuzes necessary to explode the shells on their striking the point aimed at, are exhibited in great numbers, and are wonderful in contrivance.

We have three kinds, viz., time, percussion and concussion fuzes.

Among the best are the time fuzes, combined with the Laidley friction igniter, as seen in the Eureka Fuse.

A bad fuse will prematurely burst the shell in the gun and destroy the gun.

Mr. Parrott said that his big guns, in the Navy, endured well. This may have been due to the cleanness of the guns on the water, for on land the rifled grooves would get clogged with sand and earth thrown up by the enemy's shot, or introduced on the rammer.

Our Generals dislike to fire oftener than is necessary, as every shot diminishes the life of the gun. A perfect record is kept of each shot fired, and when 500 shots have been expended, the life of the gun is half over.

We had a 30-pounder on Morris Island which fired 4,606 times, at 40° elevation, and most of the shells, 4,253, reached the city of Charleston. I made a post-mortem portrait of the fragments.

At the mouth of the Savannah River, on Cockspur Island, stood a casemated fort, called Fort Pulaski. The walls were of the best brick, laid in hydraulic mortar or cement, and 7½ feet in thickness and 25 feet in height, surrounded by a ditch 45 feet wide and 6 feet deep. At the gorge, or back wall of the fort, was an earth-work, called a demi-lune, with a ditch 32 feet wide.

This fort was garrisoned by 360 men, with the full complement of officers, and was supplied with armament, ammunition and provisions. One would have thought this fort impregnable, especially as the nearest point for erecting the batteries was on the south bank of the Savannah River, one mile distant. It was there that General Gillmore established his batteries of Parrott and James' rifled guns. He opened fire on the 10th of April, 1862, and the fort surrendered at 2 P. M. on the 11th. In that short time a breach had been made through the 7½ feet thickness of wall of 30 feet wide, and then every shell was dropping on the powder magazines of the north and south ends of the gorge wall.

Without the effective powers of the big guns, Fort Pulaski was impregnable to all the efforts of infantry, cavalry and field artillery.

The breaching of the walls of such a fort, at a mile distant, was a new event in the era of military records.

The capture of the south end of Morris Island and Fort Wagner, with its strong bomb-proof shelter, adds more evidence of the efficiency of big guns.

Fort Sumter also was bombarded. It consisted of two tiers of casemates, and in a short time the upper row of casemates was reduced to shapeless ruin, and all the guns on the top of the fort, or on the barbette plain, were dismounted or knocked to pieces.

Then by means of the Swamp Angel Battery, four miles south of Charleston, we were enabled to throw shells into Charleston, which on several occasions set fire to the city.

And, from Putnum, or Cumming's Point, we threw 4,253 shells, from one gun, into the city of Charleston. This rendered it uninhabitable to women and children, and converted the city into a mere soldiers' barracks, where no business could be transacted, no quiet or comfort obtained.

No wonder that soldiers get to love their big guns, which produce such marvelous effects of waste and destruction of the powers and resources of the enemy.

I can never forget the dying admiration of an Indian chief for the cannon of the white man.* He was buried in the Congressional Cemetery at Washington. He caused these words to be engraved on his monument: "When I am dead, let the big guns be fired over me."

A big gun needs no interpreter, it speaks the language of all nations, and when the black people of Charleston, S. C., heard the Swamp Angel, they cried out: "Hark! 'Tis the voice of an angel shouting freedom," and hence the battery obtained the name of, The Swamp Angel.

DISTRIBUTION OF VERNONIA IN THE UNITED STATES.

BY PROFESSOR JOSEPH F. JAMES, M.SC., MARYLAND AGRICULTURAL COLLEGE.

Read by Title December 4, 1888.

The genus Vernonia, named for Wm. Vernon, an early English collector of plants in Virginia, includes what are commonly called the "Iron-weeds." The common name has probably arisen from the tough nature of the stem, noticeable in most of the species. The genus is a large one, containing over 400 species; its headquarters is in South America, but it extends into North America, and has a few Asian and African, but no European, species. As given in the last edition (5th) of Gray's Manual, there are but two species in the north-east United States. The Synoptical Flora of the same author adds one species and two varieties to these. The additions are variety *latifolia*, Gr., of *Noveboracensis*, *altissima*, Nutt., and *altissima* var. *grandiflora*, Gray.

The geographical distribution of the species is interesting. Two, or possibly three, *Noveboracensis*, *fasciculata* and *altissima*, are widely scattered: the rest are local, some extremely so. Some of these are confined to the country west of the Mississippi, some to that part south of Tennessee and North Carolina. None grow farther north than Vermont or Massachusetts (although one species is found in Canada), in the east, nor Dakota in the west, and none are found farther west on the south than New Mexico, nor on the north, west of Kansas. Colorado and all the country westward has no species, nor indeed any closely-allied form. Most of the species grow in wet or at least damp soil, sometimes even in swamps, only few being found in dry soil, and these being very local. Out of the fifteen species and varieties credited to the United States, only five, one-third of the whole, are given as inhabiting dry soils or plains. This almost constant association with damp places seems to fully account for the absence of any species in the west, where dryness generally prevails. The further fact that the genus is one of tropical nature will, on the other hand, account for its limited extension northward.

The two most wide-spread species are *fasciculata* and *Noveboracensis.* The first of these is mainly a central species, extending southward into Tennessee and northward into Canada. It is given in catalogues of plants of Ohio, Indiana, Michigan, Wisconsin, Iowa, Kansas and Minnesota. It is also mentioned in one list (Flora Columbiana) as occurring about Washington, although not in another (Ward's Guide to the Flora of Washington and vicinity), and is recorded from North Carolina (Curtis). These are *possible* errors. It would thus appear to be almost exclusively a Mississippi valley species, and wherever it grows it is certainly abundant. The other one, *Noveboracensis*, is, on the other hand, almost exclusively an eastern coast species, although recorded from the central States. It is given in catalogues of plants of Vermont, Massachusetts, New York (Long Island, Buffalo and Chautauqua), New Jersey, District of Columbia and North Carolina, but also from Tennessee (Nashville), Ohio, Indiana, Michigan, Wisconsin, Iowa and Minnesota There is a strong probability that variety *latifolia*, whose habitat is given as "Pennsylvania and Ohio to Florida," (Synop. Flora) is the prevalent form in the west rather than the type species The suggestion is made that students look into their specimens named *Noveboracensis* and see if they really are the type and not the variety.

The additional species, *altissima*, newly added to the area covered by the "Manual," will probably be found in many places when sought after. It has as yet been recorded from Nashville only (Gattinger).

Two species, *angustifolia* and *oligophylla*, are strictly southern, neither of them being found north of North Carolina. The first, with one variety, *Texana*, extends west to Texas, but the second is an eastern species, extending from North Carolina to Florida, near the coast. Four of the others, viz., *Arkansana*, *Jamesii*, *Lindheimeri* and *Lettermani* are all strictly trans Mississippi forms, found only in Nebraska, Kansas, Arkansas, Texas and east New Mexico. The one remaining species, *Baldwinii*, is given as western (east Missouri to Texas), but it is recorded from western Tennessee (Gattinger), but likewise from Michigan (Wheeler and Smith). We query whether this last may not be a mistake in identification. If correctly recorded in Tennessee it would indicate a tendency to spread eastward across the Mississippi.

The large number of flower-heads produced by each plant, and the number of flowers in each head, produce seeds that in the aggregate assume enormous numbers. One plant of *fasciculata* has been recorded as possessing no less than 3,290 flower-heads,* and these, if producing only twenty seeds each, a very moderate estimate, would give 65,800 fruits. This, as the product of a single plant, would be sufficient to stock a large tract of country. Each seed is provided with a number, about forty, capillary bristles, and these when ripe spread out into a head which is readily caught by the wind. As the fruits ripen the involucral scales spread, and leave the seeds standing free in the center. Ripening at a period when the winds generally blow strongly, there is every opportunity for them to be carried far and wide. Bearing this in mind it seems a little strange that so many of the species should be as local as they are. It may probably be accounted for by the late flowering habits of some, but more likely by the absence of certain necessary features in the surroundings.

It is natural to suppose two avenues by which the plants entered the United States. One by the way of the Florida Peninsula through the West India Islands from the mainland of South America; and the other by way of Mexico, into Texas and thence northward. Those entering by the first avenue would naturally spread northward along the peninsula, and mainly along the Atlantic Coast. They would most probably be plants loving damp or swampy places, such being the character of the ground they would have to cross. If spreading to the westward they would be mainly confined to the coast region. Those entering from Mexico would follow the streams, or even slightly encroach upon the adjacent higher grounds. The species entering from Mexico would migrate northward and eastward, mainly because the prevailing winds are from the south and west.

That the wind is a most potent agent for their dissemination can scarcely be denied. Baron Eggers says in regard to some of the West India Islands (Flora of the St. Croix and Virgin Islands), that until about August the winds blow constantly from the north-east. But between August and November they become unsteady and uncertain. This is the season for hurricanes and it is also about the season when *Vernonia* seeds are ripe. Thus, if then taken up by the winds, they would be carried a long way and be ready to germinate in due season if blown to a fit spot. We find now that, leaving out the widely dispersed forms, all the western species are close allies, while those of the east are also closely related.

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* *Botanical Gazette* II, p. 121.

It would appear that two sections can be formed of the species of the genus. One of these has ample, generally lancaolete, leaves, and the other has linear leaves. In the first group there are seven, and in the second, eight species and varieties. Of the lanceolete-leaved forms one is strictly southern and eastern (*oligophylla*), one is western (*Baldwinii*), but all the others are general in their distribution. But *Baldwinii*, the western species, is said to "pass into" *altissima*, one of the generally distributed forms, so it may be regarded as a form developed under special conditions. In the linear-leaved section, six out of eight are western; one of the others, *angustifolia* var. *scaberrima*, extends from South Carolina to Florida, and the other, var. *pumila* of the same species, is found in South Florida.

The first group of ample-leaved forms may be regarded as coming from the south by way of the West Indies and Florida, spreading in several cases far northward and westward, and in others adhering to the Atlantic Coast. The second group, that of linear-leaved forms, probably arrived by way of Mexico, and then spread north and east; in the latter direction partly because of the prevailing direction of the wind, partly because of the dryness of the country to the west. Besides the leaves, there is a prominent feature in some species of long filiform tips to the involucral scales. These do not seem to be correlated in any way with the lanceolate or linear leaves, nor with the distribution. The table given below represents the distribution of the two groups of species:

Leaves linear:

Arkansana: Missouri, Kansas to Texas.
Jamesii: Nebraska and Arkansas to Texas.
Lettermani: Arkansas and Texas.
angustifolia: North Carolina to Florida, Arkansas and Texas.
var. scaberrima South Carolina to Florida.
var. Texana: Arkansas, Louisiana and Texas.
var. pumila: Southern Florida.
Lindheimeri: West Texas.

Leaves lanceolate:

Noveboracensis: General but mostly eastern.
var. latifolia: Pennsylvania and Ohio to Florida.

Baldwinii : East Missouri (West Tennessee) to Texas.
altissima : West Pennsylvania to Illinois, Louisiana and Florida.
var. grandiflora : Illinois and Kentucky to Texas.
fasciculata : General, but mostly central.
oligophylla : North Carolina to Florida.

A last peculiar feature of the genus, and one that adds to its difficulty, is the occasional occurrence of natural hybrids between several distinct species. These have not been fully investigated, and the only mention found of them is in the "Synoptical Flora." Here it is stated that hybrids between *Arkansana* and *Baldwinii*, between *fasciculata* and *Baldwinii* and between *Lindheimeri* and *Baldwinii* have been found. The last was collected by Berlandier. May it not be that *Baldwinii* is itself a hybrid?

NORTH AMERICAN FUNGI.*

BY A. P. MORGAN.

(Read by title, Dec. 4., 1888.)

THE GASTROMYCETES.

FRUCTIFICATION arising from a simple filamentous or from a compound mycelium, comprising essentially a closed sac or PERIDIUM inclosing the hymenial structure called the GLEBA; hymenium lining or filling the chambers or CELLS of the gleba, consisting of numerous closely-packed branches of the hyphæ forming the basidia and paraphyses; basidia producing laterally or at the apex one to several spores, sessile or borne on sterigmata; spores spherical or elliptic, continuous, hyaline or colored.

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*The following letter to a member of the Publishing Committee is printed by permission of the writer:

PRESTON, HAMILTON CO., O., *December* 29, 1888.

MR. DAVIS L. JAMES:

Dear Sir—Along with this I send you the manuscript of the article on *Phalloideæ*. You will perceive by the title and by the contents that it is more ambitious in plan than the preceding papers. The remaining classes of Fungi are better known, and the specimens are more easily preserved and accumulated than the *Hymenomycetes*. Hence, I think, papers covering the whole field of our country, so far as at present investigated, will be far more acceptable. The *Gastromycetes* will occupy about three such papers as the present; possibly, the next two may fill a little more space.

The next paper will be on the *Lycoperdaceæ;* it is now under way and partly done. I will try and have it ready for the April number, unless the space is wanted for other matter.

The new species we had taken for *Mutinus caninus*, until the publication lately, in Grevillea, of a figure and description of that species, showing it clearly to be a different thing. It was at first supposed to be *Corynites Ravenelii*, B. & C., but the figure and description of this species show a much smaller plant with a different form

No sytstematic paper on the *Gastromycetes* has ever before been attempted in this country. The only essays hitherto attempted have been two papers, The Gastromycetes are fungi mostly of large size, growing usually upon the ground sometimes just beneath its surface, rarely upon wood. Their mycelium often exhibits an extensive development, the hyphæ uniting together into strands which in form branching and mode of growth in the substratum simulate the roots of higher plants. The peridium is a closed wall of dense texture mostly spherical in form and often of considerable thickness; it may consist of a single coat of uniform texture or more commonly it is separable into two distinct layers the INNER and the OUTER peridium. In many cases the peridium is extensively and peculiarly differentiated partly into persistent and partly into temporary parts; it is a general occurrence in the course of this differentiation that the peridium becomes strongly thickened at the base; the thickened portion either projects outward forming a stout support to the gleba or it projects inward forming a cushion of moderate thickness or an elongated vertical central column. The chambers or the cells of the gleba generally are in countless numbers seldom few and definite; they are narrow irregularly curved and branched cavities scarcely large enough to be distinguished by the naked eye. In some cases the gleba retains this primary structure throughout its entire existence, subject only to the changes in size of all its parts caused by growth and maturity; in other cases the cells of

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one on the genus *Lycoperdon*, by Chas. H. Peck, the other on the genus *Geaster*, by myself.

It is true, these are the large genera and contain half the species of the whole class. The genera of the different Orders stand about as follows:

ORDER.	*Genera.*
Phalloideæ,	5
Lycoperdaceæ,	10
Sclerodermaceæ,	7
Hymenogastraceæ,	6
Nidulariaceæ,	5
Gastromycetes,	33

Our own region, the Miami Valley, is remarkably prolific of puff-balls, and I have probably seen more of these things living and growing than any other person in the world. I have specimens of nearly every species that have been found in the United States, and among them quite a number that have not yet been noticed in print.

Very truly, yours,

A. P. MORGAN.

the gleba large and few in number are specially segregated into distinct closed PERIDIOLA containing the spores; in the most of cases however after the formation of the spores disorganization of the hymenial elements ensues caused by deliquescence. The changes in the gleba are always accompanied by corresponding varied and sometimes remarkable transformations of the peridium; the thickened base may be developed downward into a distinct STIPE with the entire peridium upon its apex; it may be developed upward into a STIPE carrying the gleba or the inner peridium at its apex, while in the one case the whole peridium in the other its outer layer remains behind as a VOLVA to the base of the stipe.

TABLE OF ORDERS OF GASTROMYCETES.

A. TERRESTRIAL.

a. Peridium double.

1. PHALLOIDEÆ. Peridium becoming transformed into a receptacle of various shape, with a volva at its base. Gleba becoming dissolved into a dark green mass of jelly.

2. LYCOPERDACEÆ. Peridium sessile usually with a more or less thickened base or sometimes stipitate, at maturity filled with a dusty mass of mingled threads and spores.

b. Peridium single.

3. SCLERODERMACEÆ. Peridium discrete from the gleba, often with a columella; cells of the gleba subpersistent.

4. HYMENOGASTRACEÆ. Peridium concrete with the gleba, indehiscent; cells of the gleba persistent.

B. EPIPHYTAL.

5. NIDULARIACEÆ. Peridium cyathiform, open at the top, containing one or more distinct peridiola.

ORDER I.—PHALLOIDEÆ.

Mycelium funicular, rooting extensively. Peridium at first ovoid, with an inner and outer coat and a thick gelatinous layer between them, traversed by a central column surrounded by the gleba; at length ruptured by the development of a receptacle of various shape bearing the gleba, and remaining as a volva at its base. Gleba becoming dissolved into a mass of jelly which dissipates in water and like the spores is of a dark green color; spores elliptic oblong, even, minute, 3–5 mic. in length.

Fungi terrestrial, of large size, characterized by receptacles exceedingly remarkable for their varied and singular shape, and possessing an extremely offensive odor.

TABLE OF GENERA OF PHALLOIDEÆ.

I. PHALLEÆ. Receptacle consisting of an elongated stipe bearing the gleba on a conical pileus at its apex.

1. PHALLUS. Pileus attached only to the apex of the stipe, dependent free all around below.
2. MUTINUS. Pileus wholly adnate to the summit of the stipe.

II. CLATHREÆ. Receptacle a hollow clathrate body, with the gleba attached to the upper part of the inner surface.

3. CLATHRUS. Receptacle composed oi obliquely anastomosing bars and sessile.
4. SIMBLUM. Receptacle composed of obliquely anastomosing bars and stipitate.
5. LATERNEA. Receptacle composed of a few vertical columns and sessile.

I. PHALLEÆ. Receptacle consisting of an elongated stipe bearing the gleba on a conical pileus at its apex. Stipe cylindric, hollow, composed of one to several layers of round-celled tissue; the gleba accupying the outer surface of the pileus.

GENUS I.—PHALLUS, MICH.

Stipe hollow within, the wall composed of several layers of round-celled tissue; pileus attached only to the apex of the stipe, dependent free all around below, the gleba occupying its outer surface.

The genus may be divided into two subgenera by the presence or absence of an appendage called the *indusium* or *veil* hanging from the apex of the stipe beneath the pileus; this veil in one group is evidently the outer cellulose layer of the stipe, in the other it is the thin membrane which separates the stipe from the pileus.

I. HYMENOPHALLUS. An indusium or veil surrounding he stipe and dependent from its apex beneath the pileus.

a. Veil reticulate, hanging below the pileus..

1. P. DÆMONUM, Rumph. Volva globose, not very thick, pinkish; segments 3 or 4, irregular. Stipe cylindric, tapering at each end, cellulose; the veil reticulate, somewhat expanded and campanulate, hanging nearly to the middle of the stipe. Pileus campanulate, somewhat oblique; the surface reticulate-pitted after deliquescence; the apex truncate, smooth, perforate. Spores elliptic-oblong 4 × 2 mic.

Growing on the ground in woods. New York, PECK; Maryland, *Miss Banning;* Ohio, *Lea, Morgan.* Plant 9 inches high, volva 2 inches in diameter, stipe 1⅛ inches thick at the middle, pileus 2 inches in height; the lower edge of the veil hangs about 4 inches from the apex of the stipe. This species is rare and not well known, the original description, like those of many of the Phalloids, is brief and unsatisfactory. We have thus far met with but a single specimen of what we take to be this plant; this we carefully figured and our discription is based upon it; of course other specimens will vary somewhat in size. The short veil and the smooth ring at the apex will distinguish this species from the next.

2. P. DUPLICATUS, Bosc. Volva depressed globose, thick, flabby white; segments 3–5, acute. Stipe fusiform-cylindric cellulose; the veil reticulate, hanging down to the volva, sometimes much expanded, often torn and shreddy with pieces adherent to the stipe. Pileus campanulate, reticulate-pitted after deliquescence; the apex acute, not regularly perforate. Spores elliptic-oblong, 4 × 2 mic.

Growing in woods about old stumps and rotten logs. New England, *Frost, Wright, Sprague, Farlow*; New York, *Gerard*; Pennsylvania, *Schweinitz, Rau;* Carolina, *Schweinitz, Ravenel*; Ohio, *Morgan.* Plant 6–8 inches high, volva 2½ inches in diameter, stipe 1¼ inches thick in the middle, pileus 2 inches in height. The long veil usually clings close to the stipe though sometimes swinging free and much expanded. The size of the meshes must be of uncertain value as a specific character, for the expansion of the veil is no doubt caused by the swinging in the breeze stretching its tissue and causing the upper meshes which bear the greatest weight to be the longest. The plants found in this country and called P. INDUSIATUS, Vent. are most likely referable to this species. In this species the gleba extends over the apex and there is no thick smooth ring encircling the perforation as in the preceding species.

b. Veil not reticulate, concealed beneath the pileus.

3. P. Ravenelii, B. & C. Volva sub-globose or ovoid, pinkish; with an inner membrane, the lower half of the veil, surrounding the base of the stipe; segments 2 or 3. Stipe cylindric, tapering at each end, cellulose; the veil membranous, scarcely half as long as the pileus and concealed beneath it. Pileus conic-campanulate; the surface not reticulate-pitted after deliquescence; the apex smooth and closed or finally perforate. Spores elliptic-oblong, $4 \times 5-2$ mic.

Growing in woods and fields about rotting stumps and logs. New York, *Peck;* S. Carolina, *Ravenel;* Ohio, *Morgan.* Plant, 5-7 inches high, volva, 1½-2 inches in diameter; stipe nearly 1 inch thick; pileus 1½ inches in height. The apex is umbilicate or finally perforate and encircled by a smooth ring. By the elongation of the stipe the thin membrane separating the stipe from the pileus is rent midway by an annular fissure, the upper half becoming loosened forms the short veil under the pileus, the lower half remaining within the volva about the base of the stipe. It is probable that in some instances the hidden veil has not been detected and plants of this species have been referred to the following one. This species vitiates the genus *Dictyophora* and it can not very well be placed in *Ithyphallus.*

II. ITHYPHALLUS. Stipe without an indusium or veil dependent from its apex.

4. P. impudicus, Linn. Volva globose or ovoid, white or pinkish; segments 2 or 3. Stipe cylindric, tapering at each end, cellulose, without a veil. Pileus conic-campanulate; the surface reticulate-pitted after deliquescence; the apex smooth, at first closed, at length perforate. Spores elliptic-oblong, $4-5 \times 2$ mic.

Growing on the ground in woods. New England, *Frost, Farlow* New York, *Peck, Gerard*; Carolina, *Schweinitz*; Ohio, *D. L. James;* Nebraska. *H. J. Webber;* California, *Harkness.* Plant 6-8 inches high, volva 2 inches in diameter, stipe 1¼ inches thick, pileus 2 inches in height. By the elongation of the stipe the thin membrane which separates the stipe from the pileus is torn into shreds and the pileus is thus liberated from the stipe except at the apex.

5. P. rubicundus, Bosc. Volva small, gray. Stipe fusiform,

red, cellulose, without a veil. Pileus conic-campanulate, bay, the surface even, the apex perforate.

Growing on the ground about old stumps. New England, *Frost;* New York, *Schweinitz;* N. Carolina, *Curtis*; S. Carolina, *Ravenel*; Alabama, *Peters*. Plant 6-7 inches high, stipe about ¾ of an inch thick in the middle, pileus 1 inch in height. This plant though so frequently met with does not appear to have been described again since the time of Bosc; it is desirable that some one finding it should make a careful study of it and give a fuller description.

Genus II. MUTINUS, Fr.

Stipe hollow within, the wall composed of a single layer of round-celled tissue; pileus wholly adnate to the summit of the stipe, the gleba occupying its outer surface.

1. M. CANINUS, Huds. Volva ovoid or oblong, pallid; segments 2 or 3. Stipe cylindric, white or reddish, cellulose, tapering downward. Pileus determinate, oblong-ovoid, flesh-colored; the apex acute, perforate or imperforate. Spores elliptic 6×4 mic.

Growing on the ground in woods. New England, *Frost;* New york, *Warne.* Plant about 6 inches in height, the stipe ½ an inch thick, the pileus occupying nearly 1 inch of the apex, volva 1 inch in diameter. This species is nearly destitute of the peculiar Phalloid odor. A figure of it may be seen in Grevillea, Vol. 17, plate 173.

2. M. BOVINUS, Morg. n. sp. Volva oblong-ovoid, pinkish; segments 2 or 3. Stipe cylindric, tapering gradually to the apex, white or pinkish below, bright red above. Pileus indeterminate, conic-acuminate, perforate at the apex. Spores elliptic-oblong, 4—5×2 mic.

Growing in rich soil in cultivated grounds and in woods. Ohio, *Morgan.* Plant 4-7 inches in height, the stipe ¾ of an inch in thickness, the volva not much thicker and 1-1⅓ inches in height; the pileus occupies 1-2 inches of the pointed apex, but is not definitely limited below. This plant has the strong disagreeable odor of other Phalloids. See plate III.

3. M. BREVIS, B. & C. Volva globose or ovoid; segments 2 or 3. Stipe bright red, coarsely cribrose, attenuated below. Pileus somewhat broadly clavate, sometimes conical, but always more or less obtuse, perforate at the apex.

Growing on the ground in fields and gardens. New England, *Wright;* New York, *Peck*, *Howe*, *Gerard;* Carolina, *Curtis*, *Ravenel.* Plant 2-3 inches high, stipe 4·5 lines thick, the volva ¾ of an inch in diameter, the pileus sometimes half as long as the stipe. This is *Corynites brevis*, B. & C. of Curtis's Catalogue; it was afterward described in Grevillea under the name *C. Ravenelii*, B. & C. *C. Curtisii*, Berk does not appear to possess any distinctive marks separating it from the present species. See Transactions Linnæan Society, Vol. xxi, p. 151, tab 19.

II. CLATHREÆ. Receptacle a hollow clathrate body composed of oblique bars or vertical columns with the gleba attached to the upper part of the inner surface.

Genus III. CLATHRUS, Mich.

Receptacle a sub-globose hollow net or lattice-work, composed of several obliquely ascending and anastomosing bars, forming numerous meshes, and sessile within the volva. Gleba enclosed within the net and attached to the upper part of the inner surface.

1. C. CANCELLATUS, Tourn. Volva sub-globose, burst irregularly into several segments. Receptacle obovoid, sessile; the bars variable in width, more or less compressed, transversely wrinkled, forming irregularly polygonal meshes, red rarely yellow or whitish.

Growing on the ground in woods. New York, *Clinton;* Georgia, *LeConte.* Plant 3-5 inches in height, the volva 2-3 inches in diameter. Possessing an extremely fetid odor.

2. C. CRISPUS, Turp. Volva globose, burst irregularly into several segments. Receptacle globose, sessile; the bars transversely wrinkled and knotted, cinnabar-red; the meshes round or oval, very large below and in the middle, very small at the apex.

Growing in sandy woods. Mexico, *Leveille.* Plant 2-4 inches in hight, the volva 2-3 inches in diameter.

Genus IV. SIMBLUM, Klotsch.

Receptacle a sub-globose hollow net or lattice-work, composed of several obliquely ascending and anastomosing bars forming numerous meshes, and borne at the apex of an elongated stipe; stipe hollow, composed of several layers of round-celled tissue. Gleba enclosed within the net and attached to the upper part of the inner surface.

1. S. RUBESCENS, Gerard. Volva sub-globose, whitish, burst irregularly into 3 or 4 segments. Receptacle depressed globose,

deep fleshy red, stipitate; the bars compressed and transversely wrinkled, forming pantagonal meshes; the stipe cylindric, cellulose, red above, paler below, tapering toward the base, rounded at the apex and strongly constricted at its junction with the receptacle. Spores elliptic-oblong, 3 mic. in length.

Growing among grass in open land. Long Island, N. Y., *Gerard;* Nebraska, *H. G. Webber.* Plant 3-5 inches in hight, stipe ½-1 inch in diameter at the thickest part, the receptacle always a little broader than the stipe; meshes about 26 in number. Odor slightly nauseous.

Genus V. LATERNEA, Turp.

Receptacle a more or less elongated body, consisting of a few vertical columns arising separately from the base of the volva and joined together only at the apex. Gleba suspended from the apex within the receptacle.

1. L. COLUMNATA, Bosc. Volva obovoid, burst irregularly into 3 or 4 segments. Receptacle composed of 4 vertical columns; the columns thick, 4-angled, tapering upward, cinnabar-red Spores elliptic-oblong, 4–5 × 2 mic.

Growing in sandy woods. North Carolina, *Curtis;* S. Carolina, *Bosc*, *Ravenel*; Georgia, *LeConte*; Florida, *Ravenel.* Plants 3 5 inches in height, the volva 1½-2 inches in diameter. Extremely fetid.

2. L. TRISCAPA, Turp. Volva obovoid, bursting irregularly into 2 or 3 segments. Receptacle composed of 3 vertical columns; the columns slender, terete, tapering upward, white below cinnabar-red above.

Growing in sandy soil. Texas, *Ellis.* Plant 2-3 inches in height, volva 1½ inches in diameter.

"RIVERSIDE SKULL."

By A. J. Howe, M. D.

(Read, Dec. 4. 1888.)

At the November meeting of the Cincinnati Society of Natural History were exhibited two fossil specimens, the one being a human cranium, and the other a part of an elephantine tusk in a fragile state. Both relics were unearthed two or three miles down the river by workmen quarrying gravel for railroad purposes at Riverside; and were cared for by Dr. Kusnick of that place. He reports that the "remains" were encased in coarse gravel — the skull was found in the first cut made in the terrace north of the railway. It rolled down with a mass of gravel and clay, rendering it impossible to decide upon the exact position of its original bed. The tusk was found in the second cut, and at an equally uncertain depth. It had lost its character as ivory; and was too brittle to be handled without breakage. A sharp curve near its apex, together with its great size at the base, indicates that the dental product belonged to a mastodon. An elephant's tusk is less curved toward the point.

The cranium was fragmentary, yet the walls of the brain-case are well preserved. The specimens were entombed in river drift or wash, yet at a point too high to be reached by recent or modern inundations. The pebbly bank in which they rested was deposited when the Ohio flowed at a higher level than it does at present. The pile of gravel in which they were found constitutes the middle one of three ridges the river has developed in its washings through a series of centuries. The "bottom," or lower portion of Cincinnati is on the first terrace; a plateau sixty feet higher, on which most of the city is built, has been called the "second terrace;" and the high banks above may be termed the "third terrace." The first terrace is subject to annual overflow. The river has evidently cut its way down to its present channel, the rate of erosion being estimated at a foot in a century. The cutting process may have been more rapid at an early period of the history of the Ohio Valley.

At several points in America the remains of man and the mammoth are found in the same locality. In Europe a similar state of things has been observed. In the Madeline cave of Dordogne, a plate of ivory was discovered, having engraved upon it the figure of a mastodon, with eyes, tusks, and general shape so exact that the barbarian artist who lived cotemporaneously with the beast, must have had a living specimen to sketch from. The engraved tusk of ivory was found in such relationship with the implements of the earlier races of mankind that there can be no question in regard to the existence of the two beings at the same time.

But in this departure from my chosen topic I have not intended to convey the impression that the Riverside skull and the tusk found above it were anything more to each other than that they were incidentally engulphed in the same gravel pit.

The orbits of the cranium, the nasal chambers, the aural cavities, and other crevices were packed with a clayey soil peculiar to the earth on the top of the hill, above the gravel bank. It is highly probable, then, that in land slides which are constantly occurring along the crest of the ridges overhanging the river basin, the skull was carried from its original burial place down the steep declivity to the pebbly bed where it was lately found. During some inundation subsequent to the slide, the tusk plunged from its primary resting place higher up the river, and lodged in the superimposed gravel, where it was at length disentombed by railroad navvies. The fragile condition of the ivory— a material which resists disintegration longer than bone—shows that the tusk has been subjected to the ravages of time much longer than the fairly-preserved cranial bones. Mere superposition in the shifting banks of a large river is an unreliable test of the relative antiquity of imprisoned objects.

The cranium, or what remains of it, is browned with the alluvium of its original interment; and is somewhat fragile. The bones of the face are lost both maxillæ are wanting, also the malar bones, as well as those of the nares. The ethmoid is gone, and parts of the sphenoid; but the plates of the skull have maintained the boundaries of the cranial cavity. The outline of what is left quite accurately represents the average brain-pan of the savage Indian, or of the Moundbuilder. The forehead is rather low and notably retreating, though not to a degree to be called simian — not even equal to that of the lowest savage. The upper jaw being absent, "the facial angle" can not well be determined. However, it is far from being as near a right-angle as that of Agrippa, or of approaching a match for the ideal "front of Jove." But the facial angle established by Camper does not mean as much as its author would have us believe. The skull of the Marmoset monkey presents an approach to a right-angle as near as that of a philosopher. Mental capacity depends not altogether upon a prominent forehead, but largely upon the quantity and quality of the brain, as a whole. Even a big brain is sometimes indicative of a block-head. The absence of jaws in a cranium makes the forehead appear low and sloping. Actual measurements of the Riverside skull do not sustain the impression of its being pithecoid. External tests with callipers show its longest diameter – from glabella to inion—to be 7 inches, its width between parietal prominences to be 5½ inches and from vertex to basilar process of occiput to be 5⅓ inches; These measurements indicate that the cranium is neither dolich. ocephalic (long-headed) nor brachycephalic (short-headed). The. zygomatic processes are only averagely developed, and the temporal fossæ are not decidedly deep, to represent unusually powerful masticating muscles. The brain-pan is as capacious as that of the average savage—almost as large as that of the medium white man. The Riverside skull holds 90 cubic inches, therefore a brain which would fill the cavity must weigh 57⅛ ounces. The cranial capacity of a Digger Indian, whose skull was sent from California, is identically the same—90 cubic inches. In making the measurements, avoirdupois weight was employed. Troy ounces are for weighing gold, silver, and medicines. The avoirdupois scheme calls for 437½ grains to the ounce, and 7,000 grains to the pound. The metrical system is at present in reputable use for scientific measurements, but is not in common employment. A *gramme* contains 15.5 grains, therefore it is a mere matter of mathematics to ascertain how many *grammes* there may be in one ounce. I have learned experimentally that there are 278 grains in a cubic inch of human brain, hence it is a sum in arithmetic to determine how many grains or ounces, or even *grammes*, there may be in so many cubic inches. A cup an inch square represents a cubic inch; and if small seeds be used to pour from the full cup into the foramen magnum of a skull, the cubic capacity of the brain-pan may be ascertained. If the number of cubic inches be multiplied by 437½, and the amount be divided by 278, the number of avoirdupois ounces may be learned.

Certain craniologists have employed Troy weight to determine the ounces a brain may weigh, hence some confusion has arisen as to cerebral ponderosity. The brain of Cuvier weighed 1861 *grammes*=28945 grains—or 66 ounces; that of Byron weighed 1807 *grammes*= 28009 grains, or 64 ounces. The brain of Agassiz weighed 64½ ounces, and that of Humboldt 65½ ounces. These figures are only approximately exact.

The other day I selected two skulls from our Madisonville collection, the larger would hold 57 ounces of brain, and the smaller 42 ounces. The smallest approaches the diminutive in capacity; while the largest attains the dimensions of the very biggest skulls. A man has a large brain which weighs 56 ounces. The smallest brain in the Leipsic collection—that of a native Australian—weighed 35 ounces. The gorilla and the chimpanzee have brain-pans which hold from 28 to 36 cubic inches, which weigh from 20 to 25 ounces of brain. There is a pronounced difference between the cranial capacities of the larger apes; and there is considerable difference between the largest anthropoid brain and that of savage man. Approach in size means very little. A whale has as large a brain as is possessed by a statesman. An elephant has more brain than any other animal.

In regard to the age of fossils, I beg to say that great scope is given to speculation. A petrefaction is a fixture—it. belongs to some geological era or epoch, with relationship to other periods in palæontological history; but a fossil picked out of the drift in a pile of river gravel is an object upon which there may be ventured the wildest theory as to its perambulations. If we could determine the period at which the Ohio ranged fifty feet higher than it now does, we might conjecture the age of the Riverside skull. From what scientists write in regard to the time when the first organism appeared upon our planet, carrying the event back millions of years, the discrepancy of a thousand years might be made in the reckoning, and the result be not far out of the way. In the infinity of time the span of a century is an insignificant leap—is as a day or an hour. The skeletons of the Madisonville cemetery were overgrown with forest trees whose annular rings count 700 or more. Probably the burials reach back 800 or 1,000 years. An older history can not be claimed for them. I conjecture that the Riverside skull is as ancient as any of the crania in our cabinet, unless there be an embalmed Egyptian skull in the collection. Skeletons taken from the pits of the older mounds are very fragile—time has disintegrated them.

A few years ago the underjaw of an elephant (extinct variety) was unearthed while quarrymen were excavating a sewer on Central Avenue (this city). The bone was at least 40 feet above the late inundation, and deeply buried in gravel, and in a too good state of preservation to be ten thousand years old. In a cave or peat-bog, where chemicals of a protective nature are present, a bone may be preserved a million of years, but not in a gravel bank. In the course of time a bone loses its cohesive properties, and crumbles like slacked lime. Possibly the elephantine maxilla recently exhumed, and the fossil skull, have been buried in their pebbly beds for 1500 years; yet their firmness could not be maintained for thousands of years. It will be excusable in me if I do not venture into a broader speculation; but the subject is open to free discussion. That the Borreby skulls of Denmark, and the Enghis and Neanderthal crania, are older than the one under observation, I have not the slightest doubt. In fact, I look upon this as comparatively modern. There is a question about the antiquity of the Calaveras skull—an earthquake may have determined the overlay or superposition. Herculaneum was buried two thousand years ago; and the skeletons of the overwhelmed inhabitants are well preserved; and it is not improbable that they may continue to resist disintegration for ten thousand years. I mention the circumstances to illustrate how uncertain it is to speculate upon the age of fossils.

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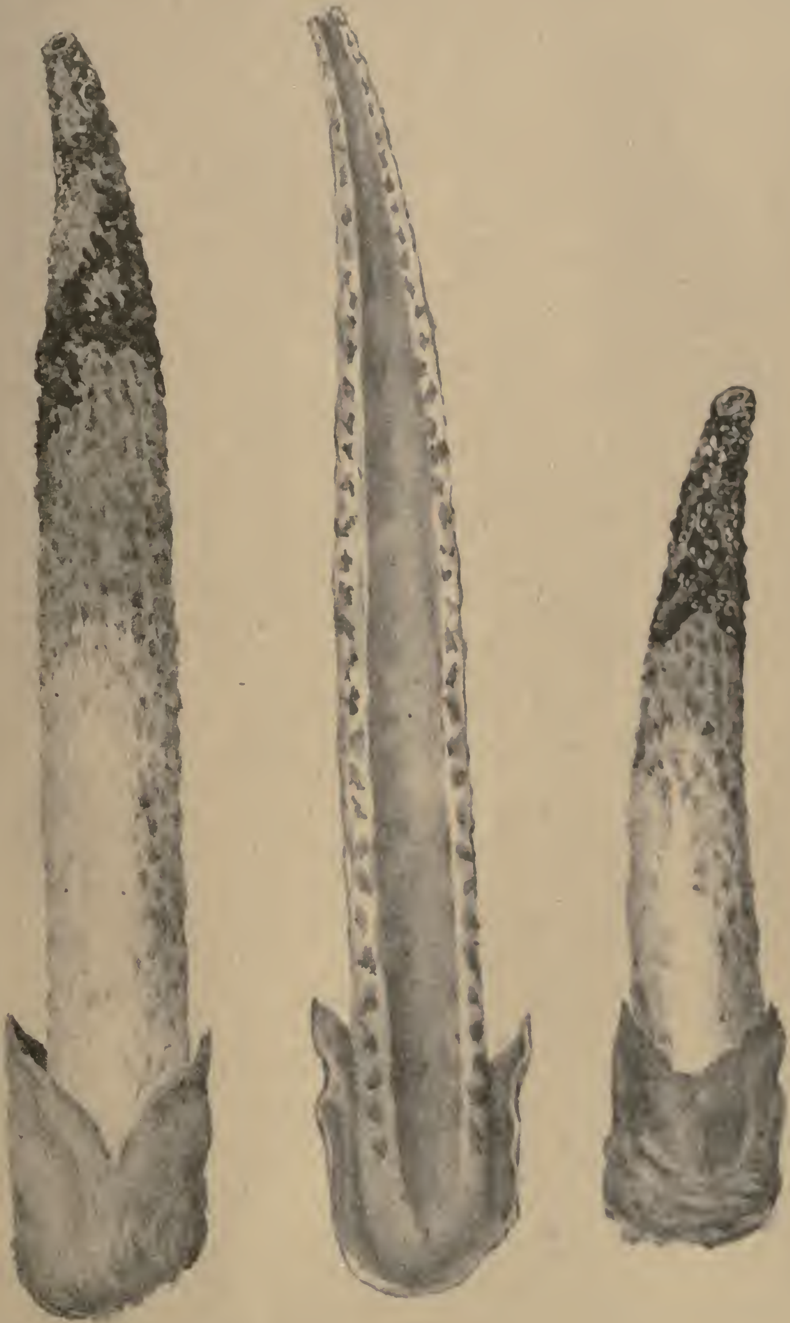

Mutinus Bovinus, Morg.

Laura V. Morgan Del.

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TO THE

JOURNAL

OF THE

Cincinnati Society of Natural History,

VOL. I TO X INCLUSIVE,

INCLUDING INDEX TO PART ONE OF "PROCEEDINGS" OF THE SOCIETY
(ALL PUBLISHED).

COMPILED AND ARRANGED BY

JOSEPH F. JAMES. M. S.

PROF. OF BOTANY AND GEOLOGY IN MIAMI UNIVERSITY, OXFORD, O.,
AND OF BOTANY IN THE DEPARTMENT OF PHARMACY OF
THE UNIVERSITY OF CINCINNATI. FORMERLY
CUSTODIAN OF THE CINCINNATI SOCIETY
OF NATURAL HISTORY.

REMARKS.

The authority placed after a species indicates its description for the first time, *i. e.*, shows a new species. The addition of an asterisk (*) shows it is accompanied by a figure. If the asterisk (*) alone is present it indicates an old species figured. If the authority is not accompanied by an asterisk (*) no figure is given of the newly described form. If no authority or asterisk is given, the species is either re-described or some note is indicated. The figures enclosed in circles—*i. e.*,—(47) indicate the incorrect paging of the second number of volume IX. The figures following are the corrected pagings. Under the head of "Proceedings" of the Society will be found reports of the various officers, and short notes on miscellaneous subjects which came up during the meetings and which were generally not more fully noticed elsewhere.

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ABBREVIATIONS.

S. A. M. = S. A. Miller.
Cham. = V. T. Chambers.
Weth. = A. G. Wetherby.
M. & D. = Miller & Dyer.
Ul. = E. O. Ulrich.
Mr. & Ald. = Meyer & Aldrich.
Ald. = T. B. Aldrich.
Whitf. = R. P. Whitfield.
Morg. = A. P. Morgan.

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